Challenge Paper Consolidated Feedback

The Challenge Dialogue System™

Inventory Program Review: A Challenge Dialogue with Stakeholders

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Inventory Program Review:
A Challenge Dialogue[1] with Stakeholders

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[1] This Challenge Dialogue System™ was developed by the Innovation Expedition — it is a disciplined process that engages diverse groups on discovering collaborative and innovative solutions to complex challenges. www.innovationexpedition.com.

Input Request 1: Key Challenge and Background

INPUT REQUEST 1: Please provide your feedback (reactions, questions, suggestions) to the Key Challenge and Background statements.

- Do you have any comments you would like to make about our Forward section regarding terms, current scope and assertions?
- What questions do you wish to raise about the Key Challenge statement?
- What ideas did the Key Challenge statement spark in your mind?
- What reactions, questions or suggestions do you have with regard to the Expected Outcomes?
- What expectations do you have for this Challenge Dialogue (as in: "I would consider this Dialogue a success if...")?

P1	Agree, we need better inventory data/remeasurement/understanding of what is on the landbase. Key management decisions/determinations are made on this data and we need to have the best, must up to date data that is possible. Funding and responsibility issues are critical, as the "stewards" of the forest we need the funding and resources to carry out this challenge
P3	It is March 28th and we just received a copy of this information. We have 15 GIS analysts and 30 forest professionals in our office that work with the forest inventory data daily. However we were just notified of this program today. A day before the deadline for submissions. We think you need to have a couple meetings with users. Possibly in Kamloops and the Peace. Invite the licensees, consultants and government users to comment. An e-mail and a slew of files on the internet isn't a great way to co-ordinate change management. You have an oil tanker moving through the ocean and you are trying to move it with a sailboat. I think to get buy-in you will need to talk to people in person. There is no use in co-ordinating a train the trainer workshop and additional training workshops if there is no work. We have attended workshops and week-long training programs several times, to only have no opportunities to apply the skills learned. Within 2 years you tend to forget what you learned. There are some better approaches to making this work that have been successful in other ministries. There was no discussion on Barriers to moving forward, Substitutes, Strengths, Opportunities or Weakness that should be considered. This might be a more effective way of opening up the discussion.

P4	Scope. The first paragraph about Scope is very specific in including all the technical aspects of VRI. (Phase I, II, NVAF, G& Y etc...) However, the rest of the challenge document deals with these technical issues at an extremely high level, or not at all. The Challenge paper scope, as interpreted from the challenge paper it self, is more to do with Governance, funding model, delivery model, user needs and applications (appropriate and inappropriate) for the inventory data. These are "program delivery issues", not technical issues. Perhaps this process is high level and focused on program delivery. At what time will there be a discussion on the technical details of the VRI? Particularly issues like inventory reporting. I would consider the Challenge Paper process a success if the Chief Forester, as the primary client of the VRI through TSR – AAC determinations, takes responsibility for the inventory of the province and uses his position to secure regular steady staffing and funding to deliver a provincial VRI that is current, complete, and statistically robust. The inventory needs a champion.
P5	The key challenge statement tells me that if Inventory branch proceeds as discussed, the concerns/needs of the Protection program can be met. My expected outcome of all this will be to establish a good working relationship with Inventory branch and provide for a mechanism that allows for timely transfer and sharing of information/data to meet both the needs of Inventory and Protection Branch.
P6	First, I agree that the focus should be limited to vegetation. But, I do not agree that it should be limited to forested areas and nothing else. There are so many impacts on the entire landbase within a TSA or district that are real concerns for those having responsibility to manage it. For example, range burns reduce the forested component of the landscape to provide range. This also impacts the structure of FRPA values such as biodiversity. As another example, energy exploitation on the landscape, whether it be simple 3-D seismic programs to major changes in the landscape in the form of strip mining. Especially for North-East BC and South-East BC. As to the Key Challenge, I think it is a good starting point. But, unless there is the willingness to follow through on recommendations, i.e. resourcing issues and executive support for change – then all this is simply a dialogue among peers. Regarding expected outcomes, the VRI update program will need to develop a very good working relationship with the OGC to update harvesting in NE BC from O&G activities that provide timelier updates while at the same time maintaining the confidentiality of OGC licensees. [FYI...it is estimated on an annual basis that there is more land permanently "lost" to O&G activities than is harvested and reforested by MoFR licensees in NE BC.] This info is needed for the TSR process. I understand that this process will be starting in April 2006.

	To compare and contrast, the case of area impact by the MPB is similar to the situation in NE BC with seismic impacts. Except that in MPB areas most areas will probably regenerate and be modeled that way in TSR (either planted or naturally). Areas lost to seismic activities (and other O&G impacts) do not contemplate regeneration potential in TSR.
P7	1) Forward Section: There was a similar challenge paper about a year ago dealing with inventory requirements for MPB. How does the current challenge paper relate to the previous challenge paper? It seems the two should be intimately related. 2) No questions about the Key Challenge statement. 3) The Key Challenge statement gives me the idea that you are really only looking at a "tweaking" of the inventory program, rather than critically looking at whether it truly meets the requirements of today and the future. There also seems to be a pre-determined expectation that the only way to "fix" the program is for government to take back the delivery of the program. 4) The expected outcomes appear to be concerned mainly about "understandings", rather than "actions". 5) I would consider this Dialogue a success if the inventory program can be streamlined to give cost effective, relevant information for all aspects of forest management, including issues at an operational scale.
P8	Under Section 2: Governance – TFL holders are also obligated to meet inventory requirements as per their tenure agreement terms and conditions. Delivery model – For TSA's, isn't there a government responsibility for planning and quality assurance also? Funding model – From 2002 to present, FIA allocates funding directly to forest tenure holders who then determine the 'optimum' mix of investments – I would qualify this as being based on their own interpretation of optimum. Decision making at different scales warrants different degrees of quality. VRI has been implemented to support MU level decision-making. So, how does stand level info such as oil & gas disturbance get captured, since it has a significant presence at the MU level? FAIB should consider some methodology to apply more intensive sampling in some circumstances to provide higher resolution data for stand level use. I agree, we could benefit from having local update staff in districts, especially in the NE because of various overlapping tenures and uses.

P10	The expectations are reasonable and cover a lot of areas. However, from a District our expectations would include. ▪ District Roles and Responsibilities ▪ District and Regional Resources to maintain and understand the data inventory ▪ Consistent funding to allow for proper long term planning to address inventory gaps. May require District Wide Gap Analysis to identify weaknesses in the inventory and deficiencies in the information ▪ Addressing links to other data sources, i.e. MoE, ILMB, MTSA, and industry, specifically in areas of TFLs. Ability to merge datasets without error and duplication. ▪ Quality Assurance – for example the accuracy and reliability of RESULTS data is highly suspect due to lack of quality assurance and ability of Districts to correct errors, review and reconcile data with history file (i.e. opening hardcopy file) Should be broader than just Vegetation Inventory. Need to consciously link/bring in inventory requirements now and in the future
P12	The Challenge statement is clear and well written but appears to assume the stakeholders' prior knowledge and understanding of the framework and structure of the existing VRI system including the scope and limitation of use affecting different resource management objectives and planning decision levels. Furthermore it assumes that the reader has knowledge about the strength and weakness of the policy structures of existing VRI program. While this could be true for provincial and federal subject matter experts and technicians the majority of stakeholders may lack sufficient information about the "loopholes" and gaps within the current framework and structure of the VRI system. The scope should be extended to include panel sessions to examine and: ▪ identify policy gaps impacting expected program delivery schedules; ▪ identify the impact of obsolete or inadequate products, inventory methodologies and assumptions on optimum and usable products and current short-falls in inventory deliverables. ▪ survey stakeholders value preference for the VRI delivery options should be included. This will assist in capturing and quantifying stakeholders' perception of the changing needs of the industry and the community. Governance section implies that decisions are not required to be made based on sound information – is this a concern which is to be addressed? Standards should set targets in terms of results rather than prescribe a specified method of producing an outcome. What is more important? The process or the quality, contents and usefulness of the resultant products?

Comment on Expected Outcomes for 1. Key Challenge

The Action Team's expectation item 1 would be more informative if emphasis shifts from acquiring a "broad view… information needs", to a compartmentalized case by case comprehensive picture of information needs of stakeholders as well as, definition of program delivery option

What is critical vegetation information and is this the same for all stakeholders? How important is the accuracy of the information? What is timely and is this the same for all stakeholders? What are current inventories being used for? What could they be used for if more detailed, accurate and precise information was available? How could the inventories become more useful to resource managers as a whole if they were more comprehensive in content. What about the concept of total resource inventories rather than just vegetation inventories. Managers today need to consider all resources affected by their planning not just vegetation. With new technology, it is possible to inventory all resources so that a more integrated approach to resource management is facilitated. This approach is more cost effective than people might imagine.

Comment on 3.2 Vegetation Inventory

Background information is well written and very informative. Even though the discourse raises issue of potential concerns, it does not emphasize any problem areas requiring special policy intervention. It would be more informative to discover what bottlenecks (administrative, operational, financial) impede the timely delivery of VRI information to stakeholders.

It will also be beneficial to provide a ranking of the issues in some order to reflect the levels of severity of impact of the attainment of VRI objectives.

The underlying causes of the issues of concern raised do not come through very well with regards to the intended response for instance:

- sub-paragraph 8 & 16 (c), are these issues that requires policy intervention?
- sub-paragraph 8 (e), what is the impact and relevance of this under-capacity on the goals of VRI
- sub-paragraph 8 (g), again the relevance factor; is this impacting a government policy or impeding the attainment of VRI objectives to provide useful services to the stakeholder.

3.2 8a) many attributes are known to be very poorly estimated (e.g., basal area) objective measures should replace where technically possible to generate measurements with known confidence limits

3.2 8b) how often are phase 2 adjustments actually implemented?

	3.2 8e) tracking is further complicated by discrepancies of spatial units where stand boundaries change through the years with different sources of generating the lines GPS, API, Free Growing survey data etc. 11. there are other options to shorten the time required as well 12. Are there any timelines for completing the first cycle? Comment on 3.3 Growth & Yield Traditionally, growth and yield and inventory are considered separate disciplines requiring unique varying multi-disciplinary expertise. Consequently, the issue about Growth & Yield should be treated separately outside the scope of current VRI review. This will eliminate the potential to mask and confuse the real issues of concern around VRI.
P13	**Comments Regarding the Forward Section in regards to Stage 3 Future Workshop:** The Northern Interior Region would like several of its District staff participate in the May workshop. The Northern Interior Region currently has but one Inventory staff. The NIR contains a varied landscape and resource interests. Representation and participation from the Western portion; the Peace-Ft. Nelson and the Central (MPB impacted) at a minimum might be considered. We strongly believe representation and participation geographically from across the province will provide a stronger review and developing recommendations.
P14	**Forward Section Comments** While most of the forward is fine I do issue the following statements: **Funding Model** I **strongly** disagree with the assertion 'The delivery model is not well suited … to vegetation inventory.' This may be the perception at FAIB but not elsewhere. Through Industry/BCTS DFAM/LBIR groups, and without big budgets, over time we are managing to fund full VRI work in the Strathcona, Sunshine Coast, and Soo TSAs. We have also managed to form other partnerships to get VRI work implemented - like the current VRI Phase 1 work in the Indian Landscape Unit with the cooperation of the Burrard 1st Nation (they funded the helicopter time from their funding sources). While some areas, like the Mid-Coast TSA have not had a lot of work done in them, with the change of the FIA funding model to an AAC-based model from an economic activity model in the coming fiscal, there should be more opportunity to implement inventories there too. I think FAIB has not been engaged in the activity actually happening in the field and this reflects the assertions made in the front of the document.

	Delivery Model One point of clarification: While it is true that TFL holders are responsible for funding forest inventories under section 9, this requirement was quietly dropped under FIA rules. In the past, under FRBC rules, government (through ministry line budgets) and industry were required to fund 60% of the VRI Phase 1 costs with the other 40% eligible for FRBC reimbursement. The problem was that the Ministry was never able to secure line budget funding for VRI inventories, so little VRI work was done in the TSAs for a few years. When this was recognized as an issue FRBC allowed the 100% funding of inventories to let VRI work to proceed. For fairness TFL holders were also allowed to use 100% of funding on their TFLs too. Under FIA there is no funding restriction like the 60/40 FRBC split inferred in the Delivery model statement. **Key Challenge Statement** As it stands I think the Key Challenge statement should stand as is – its fine. However I was involved in both the Forest Resources Inventory Committee (FRIC) and the succeeding Business Information Management Group (BIMG) and they both had fine opening statements too – but neither went anywhere. It seems that when the "rubber is ready to hit the road" on these things the process fizzles out. My perception is that the fizzle point happens when the real work needs to be done and real funding is needed to do the work.
P15	• Challenge Statement – Some times a review of an existing process, with the goal to 'make it better', establishes unnecessary sideboards and reduces the chance of coming up with revolutionary improvements. The challenge statement may just want to state that the inventory system will be designed to meet today's and future business need in the most cost effective manner. • Scope – Page v – IPR talks to all aspects of the VRI process but does not mention the inventory (photo interpreted) adjustment phase after the ground sampling. A lot of work has been done around the adjustment phase. We need to ensure it provides value to all users of the inventory. o Keeping it focused on vegetation inventory at this point is a good idea. • Page vii – Inventories don't become out-of-date over night. Ongoing depletion and silviculture updates will go along way in keeping inventories more useable. Some priority around improving inventories over time (working on specific localized issues) will greatly reduce the need to re-inventory large areas. An upcoming emphasis area is stand characteristics in mixed stands post mountain pine beetle. • Local field knowledge of inventory may have diminished in recent years, but this should not be mixed up with the level of operational accuracy and acceptance of the inventory. VRI has focused on the TSA statistical validity with less focus on operational (stand and sub landscape) accuracy. This has lead to people "trusting" the inventory less and this may be incorrectly construed as less knowledge.

P16	I think the problem with the current inventory model is that there is no clarity around what the inventory is to be used for. If we knew what it was intended to be used for it is relatively easy to develop a program to address the stated needs. Do we want polygon, landscape unit or Management unit resolution and to answer what questions?
P18	**Terms:** It was made clear but needs to be emphasized that this review is focused on vegetation inventory only, not on all of the numerous inventories that exist. **Key Challenge Statement:** If through the review it is decided that improvements are needed, an achievable but useable time-frame should be identified for the work so that it does not become an unending project.
P19	**Forward Section** Currently VRI Phase 1 **does** include description of the trees, vegetation and non-vegetated types on so called range lands. A separate range inventory may be done but this will overlap somewhat with the VRI. Scope – for the last 5 years the VRI activities have been managed by Industry (MOF & MSRM have been lookie-lews) so your comment of looking beyond government is a slap on the cheek to forest companies that have picked up the inventory ball under FRBC and FIA and run with it. Funding Model – under FIA, individual forest companies were very restricted when it came to having the 'flexibility to move funding from one area of the province to another with minimal government involvement'. The licensees in many TSAs did not have enough TSA FIA dollars to do a new inventory but were unable to pool their FIA dollars within the company from other TSAs. **Key Challenge Statement** Footnote 1 states: 'most people involved with the current inventory program feel it is neither complete nor cohesive'. Perhaps the real situation is that most people involved with the current program do not fully understand how everything is supposed to work. I suggest absolutely nothing be thrown out until all major Stakeholders really appreciate and understand what the current vegetation inventory program 'baby' is. Why fix it if it ain't broke? **Expected Outcomes** Comment number 5 is the key one. What will be the vegetation inventory standards and specifications, the scheduling/timing and the funding vehicle?

	I will consider this Dialogue a success if ..... 'it leads to all major stakeholders in BC forest and vegetation inventory being truly aware of the benefits and weaknesses of the current VRI program. This includes: appreciating the capabilities of experienced photo interpreters working in the softcopy environment and using the excellent scanned film and digital photography that is available; understanding the Phase II sampling plan and how it can be improved; being aware of new technology that is available to improve the accuracy and/or cost of fieldwork and photo interpretation (LiDAR, digital photography, airborne scanners, computer-assisted or semi-automated classification software, satellite imagery); understanding the need for ongoing G&Y and NVAF programs within government'.
P20	"Vegetation Inventory .... Does not include rangelands" Last time I looked, MoFR has broad definitions of forest land and range land, such that they overlap considerably. Although current VRI efforts may not focus on rangelands, they most certainly map and classify them "dependent inventories, studies and assessments" – This would include PEM and TEM that may rely on VRI information for identification of tree species and age class; Habitat supply modeling; **My expectations:** ▪ Underscore the importance of some level of vegetation information available province-wide for analysis, model input, monitoring and reporting ("seamless forest cover" – VRI augmented by generalized information from TFLs and Parks and Protected Areas) ▪ What aspects of VRI should be implemented within PPA to provide seamless tactical information for Pest and Fuel management strategies? ▪ Harmonize classifications – Land Cover Classification (VRI) Land Use Classification (BTM) National Vegetation Classification; structural and seral stage classifications (P&TEM, BEI) ▪ Benefits of additional development of integrated TEM/VRI and Terrain-based VRI. ▪ Use of LIDAR and other airborne sensors for Forest Structure ▪ Look to the USDA FS Forest Inventory and Analysis group to better understand what VRI-based information can be generated to benefit non-timber resource management
P21	My primary expectation for the Challenge Dialogue is to see clarification and definition of policy on joint stewardship responsibilities and obligations related to inventory and related initiatives (G&Y, monitoring) of the public resource
P23	1) Is the data collected accurate enough 2) To what standards will the data be collected to (we have lots of data that is not accurate enough for the stand level planning it is being used for). 3) We have a lot of PEM and tem done on the old inventory- pre VRI why are we using this?

P24 The opening pages of the document have some misunderstood assumptions:

On governance, volume based tenure holders have little or no vested interest in strategic level inventories at the TSA. Any expectation that they will become actively involved unless as a surrogate for government and at no costs is misguided. The failed DFAMS experiment was a step in the right direction and if it had remained coupled to a forest stewardship plan for the management unit and subsequent FIA allocations it might have worked. Unfortunately, the ministry lost it way and any hope that volume based tenure holders would step up to the plate has been lost.

Based upon my observation of a number of my private sector clients, that there is frustration to the point of desperation with the administrative procedures around FIA and FIFT funding that has wrung out of the system any incentive to do things differently.

The assertion that TFL holders pay for their own inventory is on the surface correct, when you look under the covers, it is different. If you track inventory activity on TFLs as the function of available government funds. You will observe that TFL inventory activity is directly related to those funding programs. Whether it be, Forestry Cost write offs of the 50's & 60's, Section 88 of the 70's & 80's or FRBC, FIA or FFT of the 90's, TFLs have been funded by these programs. In some cases there may have been a requirement for the industry to pay some fraction of the base, but these as costs to the industry where subject to the tax laws of the time and were write-off's as well.

Having just finished an engagement for a client, I have had an opportunity to review all of the coastal TFL resource information holdings. Most of these were completed to VRI standards of the day and paid for by FRBC. The only exception to this was Cascadia, which has had a long tradition of sampling and perhaps the finest data base of representative ground samples of their old growth but particularly the second growth, where they actual know what is out there.

The comment that "The inventory therefore must be regularly updated and periodically re-inventoried when and where there is a demand for the inventory to be more current." The notion that an inventory need to be redone 'to be more current' is very old thinking that returns to the origin of periodic inventories pioneered by Franco German foresters of the late 1800's. The broader assessment of clients based needs must drive this determination not age. Given that the original inventory was well done, that we maintain the currency of the inventory for change through an annual or biannual update cycle, that we project the inventory for yield changes with reasonable yield models then currency is not an issue. One only needs to review the audit of the 76 management units to review how well the inventory had performed.

The expected outcomes do not appear to address the paradigm of 'results based' forest management' that we have either entered or are about to enter. In this paradigm, the focus is not on the managing the how we do it but on the results generated from the actions. If we apply this model to resource inventory within the constraint set of a common set of definitions DBH, Top height .... But provide decision space to proponents to under take inventory activities under the principle of professional reliance how would that affect the capturing of a province wide data set and how would government pull this together, or would they have to?

P26	I would consider this dialogue a success if government (Politicians and Forest Service Management) and industry recognize that this VRI Inventory Program must be for all lands (crown, private, parks, TFL) of the province(this is for the people)and that it should be the responsibility of government VRI staff to ensure that the Standards for this Inventory, the prioritization of needs (when to do VRI and to what level of detail) for this VRI and the direction of funds for this VRI Inventory are controlled, administered by MoF VRI staff that have a vested interest in ensuring that a quality product is provided and in a timely manner. Whether the VRI Inventory needs to be re-address, so that only critical data is collected and whether there is a need to improve the accuracy (localization) of the inventory must be determined by all stakeholders, but only government can remain impartial to determine these needs. There is way more than just TSR Analysis interested in the Forest Inventory data and they similar to Forest Licensees should not be the only considerations for a VRI.
P29	My apologies – the comments will be brief. The timing unfortunately does not work. The brevity of my comments do not indicated a lack of interest or concern. Generally I like what I see. The problems have been well articulated and topic areas seem appropriate. In short I support the paper and look forward to the actual review process. I have been away from the day to day use of inventory for some time now so I am not directly familiar with the implementation specifics. Any comments that I may have will be based on what I consider to be principles which perhaps should be the guiding tools anyway. Input request 1. This looks pretty much like the expected outcomes from the process which developed the current VRI. I have a view of inventory (as a provincial responsibility for a public resource) that suggests that the objectives, process and technical model are not necessarily the result of dialogue, consensus nor the current version of business case. The business case that I would prefer is one that assesses the real risk to the province stewardship mandate without an adequate, technically sound, well funded provincial inventory. That technical model exists – it is the implementation and financial commitment that is lacking. So – would love to see a renewed strategic direction – financially supported with a commitment to make it happen.
P30	If we get response from a wide audience… I would consider that a success

P31	We have 15 GIS analysts and 30 forest professionals in our office that work with the forest inventory data daily. We agree with your plan to have a couple meetings with users, possibly in Kamloops and the Peace. Invite the licensees, consultants and government users to comment. To get buy-in you will need to talk to people in person. There is no use in co-ordinating a train the trainer workshop and additional training workshops if there is no work. We have attended workshops and week-long training programs several times, and then had no opportunities to apply the skills learned. Within 2 years you tend to forget what you learned. There are some better approaches to making this work that have been successful in other ministries. There was no discussion on Barriers to moving forward, Substitutes, Strengths, Opportunities or Weakness that should be considered. This might be a more effective way of opening up the discussion.
P32	I believe you got the Request No. titles mixed up, as the points above call for feedback on outcomes, so the following are comments related to the expected outcomes… I agree that with limited funds we must focus on the timber inventory as it needs updating and expansion into previously un-inventoried regions. Of particular interest to the oil and gas sector is improved VRI information for the northeast (Fort Nelson and Peace Districts). It would also be useful to have understory vegetation inventoried and mapped (via PEM/TEM) because for oil and gas, those values are as important as timber values in many watersheds. I would consider this dialogue a success if it resulted in a more consistent and functional inventory as well as stable funding for maintenance and updates of the inventory.
P33	Our challenge should be: to focus scarce resources on a targeted and specific inventory. We do not want to make the focus too broad and too costly. The current inventory as envisaged by VRI Is mostly strategic in focus: need to outline costs in making operational if that is an expectation.
P34	Terms – OK Current Scope – I am pleased to see that the scope of this review extends beyond government. Access to licensees' inventories, and the quality of those inventories, is an important issue for land use planning. Key Challenge Statement – Questions and Ideas: • How can licensees' input be utilized to meet government requirements as opposed to their own? (this may be a question of funding, custodianship) • will future funding be sufficient to provide adequate solutions to problems? Will we be forced to manage, and live with, excessive risk? I would consider this Challenge Dialogue a success if the end result was a list of realistic objectives that could be achieved in a reasonable time frame, to better support strategic initiatives such as TSR and land use planning

P36	Consider also - linkages with ministry's Climate Change initiative – may wish to provide ministry CC Task Team opportunity to respond to this CR Very informative Forward section. Consider posting/publishing. Of particular interest – Data quality & decision making (e.g. VRI designed to support MU level decision-making) ; interested in stand-level roll-ups; not clear how much of VRI is supported thru stand level assessments VRI information used in gene resource management / monitoring of in-situ genetic diversity / climate change modeling wrt species & genetic diversity Aligned with expected outcomes. I would consider dialogue a success if opportunity to provide input extends beyond CD.
P37	• In redeveloping a renewed strategic direction for the province's vegetation inventory program it is important not to loose sight of the "core roles and responsibilities that are considered to be essential elements of the program in order to fulfill government's stewardship responsibilities". This is key since at the end of the day the box that gets defined must fit within the box/boxes it was made for. • What happens if and when business drivers conflict with "stewardship responsibilities" – what process will be used to deal with this? • With the revitalization program (20% take back) there is an expectation that there will be a broader array of managers/players on the landbase (e.g., First Nations, Communities, etc) with various information needs and methods to access that information how will their needs be met • We live in a highly regulated forestry environment and determining a mandate for a governmental organization that doesn't coincide or blend with the mandate that it has been given or to place expectations on others who don't have the same mandate as you creates problems. • Expectations that I have for this Challenge Dialogue – I would consider this dialogue a success if the real issues and barriers facing the province's vegetation inventory program in fulfilling the stewardship responsibilities that government were linked more consistently with business drivers (considered part of the same rather than separate entities).
P38	No, terms, scope and assertions seem fine. No questions about the Key Challenge statement come to mind. None really. Expected outcomes seem reasonable. I would consider this Dialogue a success if you get a large number of responses with good feedback from a wide cross-section of the natural resource management community including industry, government, academia and others.

P40	1. Governance – no mention of government's overall fiduciary responsibilities for the public forest resource and how this impacts inventory issues. 2. page vii, 5th paragraph – It would be more useful to articulate the differences between "update" and "re-inventory" rather than suggest they both are responses to a need for more "current" inventory. These processes are very different in cost, methodology, timing and business drivers. 3. A huge issue is not mentioned at all, and that is **access** to the inventories collected. 4. In general there seems to be an unstated assumption that the primary users are for the most part only to be found within MoFR (and mostly focused on TSR). In fact I would suggest that the VRI is the only province-wide vegetation inventory we have and as such it is the de facto choice for all agencies, industries, interest groups, First Nations, etc, for which vegetation cover is relevant to their business. 5. Another general impression I am left with is that often (but not always) the point of view seems to be from an inventory producer's or data manger's point of view rather than a broad based user's perspective. This impression is reinforced in Critical Questions # 6, "should TFL, Park and Private Land be included"? Is the answer not obvious? How can BC claim to have the world's best forest management regime and likewise a world leader in managing our fishery, biodiversity, and species at risk with these very large gaps in the availability of the information required to manage these resources? **Ideas sparked by Key Challenge** 1st bullet – Wonder how broad a range of inventory stakeholders have been engaged. If you agree that VRI is the de facto vegetation inventory for BC then legitimate stakeholders are all groups who require this kind of information. 2nd bullet – Hope the technical experts can keep the big picture in mind when the are making recommendations 3rd bullet – This is a pragmatic approach. 4th bullet – Looking at the history of episodic and fluctuating funding for inventory (i.e. feast or famine) infers that cost is all important and that we should plan for fluctuating funding rather then hope and wish for a more stable funding world. **Expected Outcomes** I hope we can achieve these, particularly #5: a renewed strategic direction.
P41	The aging of the inventory over time is an important point. We need a viable re-inventory program that is implemented in a coordinated manner across the province. The changing dynamics of the forest need to be reflected in the inventory over time. Inventories should only be static for reasonable periods of time, and then they should be re-visited. The present delivery model does not allow for a coordinated approach to inventories over time.

P42	I would consider this dialogue a success if: 1. It is recognized that we cannot possibly do ecosystem based management (EBM), nor can we fulfill the criteria for sustainability, without the use of inventories to compare how we have progressed and to assess where we are going. Stand level management policies and guidelines does not - good forest management - make. 2. It is recognized that to be successful inventories must be designed for both strategic and operational applications, not just strategic uses. Currently strategic plans are conceived using highly abstract and generalized kinds of inventory information. When it comes time for implementation, the operational realities often overwhelm any further consideration of such strategic goals and objectives, making it difficult to follow through on them. 3. It is recognized that the answer to Doug Konkin's question is no. We do not have anyone who is responsible or accountable for the management of specific forest management areas in the Province – i.e. there are no Forest Managers (District Managers manage people and implementation of policy, not Forests). If we did, there would be no discussion about the need for up-to-date inventories, first and foremost as evidence that the Manager was doing his or her job. 4. There is recognition of the need to educate foresters in the uses of inventory information.
P43	3. The forest industry has a different focus on managing the VRI; it is a timber focus as their business is timber products. Few proponents have the longer term vision that Inventory branch has to do complete Vegetation resource plots with the Timber emphasis plots as there have been a lack of funding to do both. Industry will shift now that Forest Stewardship Plans are required and Industry is now fully required to report on such content under the FSP. Some TSA's have completed PEM with Eco plots to help build the PEM. It would be good to know that such BEC plots in the province are being included in the Library of VRI / Ecosystem
P44	• Scope: VRI is not only important to the forest sector, i.e. industry, but also to the entire spectrum of planning, operations, economic development, research, conservation and protection of the all provincial forest lands. It is the key foundation along with spatial map base and ecosystem mapping upon which most other derived data/inventories, analysis and decision-making depend. Therefore it is important to gov't, NGOs, First Nations, industry, and to the owners of the resource – the citizens of the province. • There is no cohesive "program' only elements or fragments of a program dispersed between MOFR, other agencies, licencees and contractors/consultants. Gov't mandate to prioritize, undertake and ensure the quality of new inventories has been removed, along with significant numbers of staff and operational funds. Current delivery model leads to ad hoc and poorly informed decisions because of the lack of familiarity and expertise with existing state of the inventories. Heavy reliance on consultants who do not always have the necessary institutional/historical/technical background or long-term responsibility for the outcomes has only exacerbated these problems.

	• in the "Starting Perspectives" section there is the statement which begins, "For TFLs: the licencees are responsible for funding inventory requirements……". This information is incorrect. TFL licencees rarely use their own funds for inventories and primarily access FIA funds. Also, there is only one standard, VRI, for new forest cover inventories. The Chief Forester does not specify different standards for upgrading inventories. • I would consider this dialogue a success if it resulted in a recognition of the crucial importance of up-to-date, reliable, consistent forest inventory across the entire land base, and the recognition that this desirable goal should be a high priority for MOFR/gov't leading to adequate, stable funding and resourcing being dedicated to its achievement over the next 5 to 10 years.
P45	The Key Challenge statement "To undertake a full and open review of the current implementation of the vegetation inventory program… "A major component of the Program Review and Challenge Paper is dedicated to G&Y. The statement should remove "vegetation" so that it doesn't leave the impression that it's solely a Vegetation (VRI) Review. Missing from the Challenge Review objectives is identification of service delivery gaps and Challenges and improvements of services to the stewards of the Resource. Agree and support the Expected Outcomes. I would consider the review a success if it leads to agreement regarding identification and documentation of the mission and mandate of the Ministry of Forests and Range in regards to Vegetation Inventory and G&Y and its responsibilities and role.
P46	The Expected outcomes are confusing as they seem to overlap with one another. Outcome #1 is a broad, all encompassing statement, outcomes #2 and 4 state similar things and outcome #3 is a component of #1. I think the outcomes would be better stated as: 1) assessment of current and anticipated needs/issues; 2) identification and assessment of options, opportunities and solutions relative to the needs/issues; 3) business case (cost/benefit analysis) in relation to the barriers for investment from gov and licensee perspectives; 4) renewed strategic direction and **action/implementation plan** (strategic direction alone is not enough – there needs to be a clear implementation plan developed in order to set change in motion) I would consider this dialogue a success if and when change takes place. Until that point the dialogue is simply a dialogue (lip service) and can be too easily forgotten and/or ignored.

P47[2]	Usually people do not have much success in trying to be all things to all people. So I do not like the chances of the Inventory Program doing so. Let's decide what is our core business and let the "nice to do" stuff to be funded be the periodic funding bonanza's that come along like FRDA, FRBC etc. We grow and log trees. We can see trees from the air. Let the inventory speak to their location, size and the productivity of the site to which they are growing. Let the FRPA resource evaluation program go out on the ground and assess whether we have left enough CWD or suitable habitat for some animal of interest and use there information to maintain access to markets.
P48[3]	Scope: Will this cover VRI retrofit? Starting Perspectives: Governance: TSA Licensees (FIA recipients) have already accepted their role to administer inventory projects and have so far, been quite successful in directing resources on a priority basis. Funding Model: We do not expect that there can be a less volatile funding model. That is a red herring. Regional or provincial programs work if a strategic plan is presented and weighed against other priorities for each management unit. MoFR has discouraged the implementation of operational-level information at the strategic-level inventory (i.e., VRI). Utilizing data sources from old inventories, cruises, etc. is where we would like to go as well, but this is a departure from the basic standard. Besides, this is not an allowable funding mechanism. The forest industry and those who actually operate on the landbase are most appropriate to provide local field knowledge. We get the sense that the biggest concern tabled is that government personnel feel like they are spectators rather than participants. In our observation, this was actually a key driver/benefit of the FIA delivery model because inventories were being supported. Every time a significant change is made to this program, current and recently updated inventories require additional work. Focus on flexibility rather than changing requirements. What is meant by the inventory "mandate" on page 1? Consider the Government – FIA – PwC model (i.e., third party accountability) for addressing this inventory mandate. Business cases: need to appreciate that management units are not all the same. Each has its own priorities in many disciplines. This is the appropriate basis for allocating funds.

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[2] Delayed response—received after first compilation.

[3] Delayed Response—received after first compilation.

	Rather than heading in a new direction, perhaps we should first seek to clarify the current one. We would consider this dialogue a success if it becomes apparent that our interests center on addressing issues and fine-tuning things rather than supporting a movement to re-create an inventory branch/bureaucracy within the MoFR. Expectedly, this is significantly biased towards government.

Input Request 2: Expected Outcomes

<table>
<tr><td colspan="2">INPUT REQUEST 2: Please provide your feedback (reactions, questions, suggestions) to the Expected Outcomes.
▪ What critical information or perspectives on the Background are confusing to you? Are there any other issues or events that you feel should be added or that are not relevant?
▪ Please refer to the Background statements by their number.</td></tr>
<tr><td>P1</td><td>Agree with the numbered background issues listed in the section. Good coverage of the info out there, where it is and where it is heading.
3) inventory and monitoring plan critical for the districts hit by MPB
Section 3.2 6) through 16) Need to get updated VRI data in place for all districts, not just converted inventory data. With accelerated harvests on landbase due to MPB this is critical knowledge. We are potentially loosing sample areas to harvest where we may not be able to obtain same date (Pure pine areas). Again we are making critical management decisions based on this information.
Section 3.3 we need to enhance and maintain our growth and yield information. Critical data for modeling and future conditions. Need to monitor and perhaps reestablish function back into the district</td></tr>
<tr><td>P3</td><td>The information isn't confusing, but it's an example of how diverse the skill sets are and how many different persons are controlling the data. This justifies the need for a strategy, and why they need to be working together towards a common vision – goal.</td></tr>
<tr><td>P4</td><td>6. Glad to see the VRI implementation date as 1998. It initially went off half-cocked in 1995 before we had the training program in place.
8. I believe there are 4 tools that answer "How Much?"
a. Phase 1
b. VDYP – After the photo interpretation is complete, the VDYP is used to calculate stand volumes. Phase 1 + VDYP = the Estimated inventory.
c. Phase 2
d. NVAF.
8. To the question "Where is it?"
Phase1– the delineation and digitizing of polygons and their storage as a layer on a GIS is how we answer "Where it is"... Phase 2 has nothing to do with "Where it is"
The Map – in a GIS - answers Where.
9. VRI has been implemented to support management unit level decision-making...We run into problems again and again with people expecting polygon accuracy...This expectation is a major source of our credibility problems.</td></tr>
</table>

	11. timeframes for completing VRI. Three to 4 years is optimistic. My experience with 2005 image acquisition is that the processing will not be complete until May 2006. This throws the tentative schedule in the challenge paper out by 6 months in the first year. We need to speed up the processing of photography / digital imagery. 16. b. This describes the legislative and policy framework – current paradigm very well. The conclusion – Put responsibility for Inventory back into the MOF Act. Is a very important conclusion – change to the current paradigm. c Loss of expertise due to reorganization and retirements has been significant. The inventory program and a parallel training initiative will need to be ramped up and maintained for several years just to return to the capacity we had achieved in 2000. 17. Timber emphasis. The challenge paper talks about Benefit over Cost analysis again and again... The VRI eco sampling program has been small because an eco data user with the money to pay for it didn't step up to the plate. Eco sampling may re-emerge, but I believe it can be pared down to a plant list and BEC site series determination. This will support SIBEC and other site tools. I don't think the money to pay for all the eco data in the current sampling design is going to be available in the future. Coarse Woody Debris, which sits in the never never land between eco and timber will emerge as very important information as the MPB volume goes through its decay cycle. 23. What have you got? Where is it? HOW IS IT CHANGING...? VDYP 7 and other growth tools will need to be supported by strong field program.
P5	It all makes sense to me. I have a good background in working with G&Y, SIBEC, PEM, TEM, etc.
P6	My comment is not about any particular item that is listed in the Background statements. But, it is about what I think may be the missing link to the new FRPA legislation, i.e. the 11 FRPA values. It is hinted at in background statements 4, 7, 10, 14, 16, 23 and probably 24 & 25 as well. Is there a thought to linking the FREP program to the Inventory program? When looking at the development of the FRPA mandated FREP program it has very many similarities to the VRI Ground Sampling program (CWD and timber plots). It might be worthwhile to investigate whether some links could be developed between VRI and FREP initiatives...?! Just an idea. Maybe just for training exercises to realize some synergies?!

P7	Background 8(e), 8(f), 8(g). In other sections of the challenge paper, it has been indicated that the VRI standard was designed to address both timber and non-timber values. However, for inventory update (8e), site productivity (8f), yield projection (8g), the focus appears to be only on timber values. This is evident from the reference to forest cover polygons, site index etc. Very little thought seems to have been given to the process for updating the non-timber attributes. We have found this to be an issue for update of our TFL VRI inventory where no one seems to know how to update this information. If it isn't going to be updated to reflect changes to vegetation from harvest and silviculture activities, why was it collected in the first place? Background 9 & 10. It is stated that VRI has been implemented to support management unit level decision making and that it is inadequate for spatial analyses. However, most of us operate at the stand level. Most modeling exercises that guide decision making at a watershed level require stand level information since these are by nature spatial exercises. These watershed level analyses need to be compatible with direction provided from the strategic analysis. Perhaps more attention should be given to developing an inventory system that addresses requirements beyond the 5 year requirement for AAC determinations. If the inventory is only intended to address strategic level decision making, is it necessary to go to the expense of collecting all of the additional non-timber attributes? Background 12. What was the thinking around the 10 year update cycle when each inventory requires three years to complete? This means that roughly 1/3 of the province will have one of the inventory phases occurring in any given year. Were the resources required to undertake a project of this magnitude fully understood? It should be no surprise that the first cycle has not been completed. Background 16. I believe you need to look beyond the three reasons you have listed (competition, legislation/policy, capacity) for the reason that the inventory has not been completed. You should also at least ask the question about whether the inventory has had value for all stakeholders? Projects that give useful results for the stakeholders will generally rate higher on the priority list for funding. Background 24. How is the NFI funded? Would there be more value to the province if these funds were directed to provincial inventory? Can the data collected serve both inventories?
P8	Item 8, e. Although the emphasis is on forestry related activities, in the NE there are other stakeholders operating on the land base causing sometimes even more significant disturbances, and ideally these need to be captured as well (Oil & Gas, wind farms, coal mines, etc.)

P10	#8, 11 What about the use of digital photography and satellite imagery – inventory work and updating through remote sensing and image processing #8 Are we collecting and storing the right data, i.e. year of establishment rather than age, calculate volume on the fly rather than continuously updating and storing the data. #13 Ability to capture and use RESULTS data on second growth information. Caution must be exercised in the use of this data at the present time as the quality and accuracy of the information is suspect due to the number of people inputting data and the lack of District ability to deal with inaccurate information efficiently. #15 Ability to use RESULTS data and improvement to G&Y tables for each species. More research is required, but projected values could be base on G&Y tables, possibly reducing time in inventory updating and data storage. #19 Where does terrain, UWR, OGMA, VLI, etc fit into the picture, this could play a role in OAFs but definitely affects decision making, resource stewardship monitoring, and C&E. #23 G&Y is not the only sector to suffer because of government decisions, updating, VRI completions, ensuring quality products in all areas of data capture and inventory have suffered due to lack of District and Regional Support and direction. PEM data difficult to achieve quality and statistics because of poor inventory, lack of knowledge on the process, reliance on outside expertise and limited time or knowledge from District Staff on inventory and standard procedures and information prerequisites (i.e., it is preferable to have VRI prior to commencing with PEM).
P11	8b: The original concept of VRI included sub-sampling phase 2 samples using within polygon variation (WPV) sampling. What happened to this sample, and what is the impact of not sampling for variation when adjusting inventories? 8c: States that NVAF requires that phase 2 samples have been installed, but a concurrent sampling method exists that doesn't require pre-installation of phase 2 samples. The NVAF process is increasingly important, as it will replace DWB factors (excepting breakage) for coastal call grade appraisal cruising. 16a (or perhaps 16d): The combined cost of full-phase VRI contributes to a lack of VRI investment, as discussed at MSRM/TFL inventory meeting, October 2003.
P13	3. Mountain Pine Beetle Recent interest in Inventory has been generated as a result of the MPB epidemic in the interior of the province. A negative side effect of this overwhelming event is that other parts of the province receive less attention. The non MPB impacted forests and the TSAs not affected are the future timber supply for the province. Hopefully the Inventory Program is able to fund new inventories to other parts of the province. We need a Program that works for all part of the province.

	21. G&Y Knowledge and Tools In the late 1990's considerable interest for Mixedwood modeling existed. Under MSRM it fell off the agenda. With the effects of MPB in the Interior and Deciduous –Coniferous mixed forest in the Northeast Mixedwood Growth Modelling has again risen in interest. Is any provision being considered to Mixedwood modeling? Updating and Maintaining the Inventory for disturbances should be included in the Review. Timely mapping for harvesting but also for other disturbance types from oil & gas activities; fires; mining and range require address. How often the information is updated needs to be decided, as it may not all reside in RESULTS.
P14	**Expected Outcomes** Without being flippant, I think another goal should be for FAIB to have a clearing understanding of the current processes. The whole tone of the front of the paper makes me believe they don't (and I hope the "not throwing out the baby with the bath water" is true). **Background** As background information it is fine but section 3.2 point 10 VRI as a spatially explicit inventory I think it is a bit leading to say "polygon-specific may be unreliable". A conclusion might be to make it more reliable so more general users can trust using it.
P15	Sec 3.2 - #8 & 9 - Page 4 – Inventory information must have greater credibility at the sub-strategic level. Stand level accuracy may be too costly to guarantee but more priority must be given to the sub strategic accuracy of the inventory. Drainage and landscape unit analysis will be more important as we move into FSPs and stand level data will be the basis for this. Stratification and photo scale standards do not meet this business need. A vehicle to communicate and update inventory data from on the ground observations must be made available to field practitioners. Too many barriers are in place to efficiently capture this information. On the ground observations with a little bit of rigor is more accurate that 1:30,000 photo interpretation. Section 3.3 – Inventory volume predictions should incorporate methodologies employed in timber supply analysis. Managed stand yield equations (TIPSY) should be used for managed stands and VDYP used only for unmanaged stands. VDYP and TIPSY yield curves should be audited and adjusted as necessary.
P16	8d. Are the phase 1 photo estimates really improved by adjusting them. I do not think this has been proven and therefore should be tested. If it is true, is it true only at the management unit level and if so who cares? 9. With regard to the use of VRI for strategic analysis, strategic analysis at what scale? We are going more spatial with all we do. Is the VRI going to come with us or is it only useful at a scale no one cares about? 10. If it is spatially explicit we should strive to make it as accurate as possible. 14. The reason there has been no monitoring is a lack of leadership by government on this

	and the value has not be demonstrated. 16. Yes put responsibility for inventory back in Forest Act. 17. You only get timber emphasis plots as the utility of the other attributes has not been demonstrated relative to the cost of collection. 19. OAFs and site productivity. I have never made this connection.
P19	**3.1 IPR and Related Initiatives** **3. Mountain Pine Beetle Area Inventory & Monitoring Action Plan** The September 19, 2005 *Plan for Pine Beetle Dollars Release* indicated that $10.9 million of the $100 million federal funds (Mountain Pine Beetle Emergency Response: Canada-B.C. Implementation Strategy) would be used for forest cover data. Uh-huh? It doesn't seem that any of the five priority theme planned actually areas involve forest cover data or 'Mountain Pine Beetle Area **Inventory** & Monitoring Action Plan' as in the title of this section. Monitoring, yes – Inventory, no. The assumption is that Uplifts in the AAC in beetle infested TSAs are being determined without good forest inventory information. **4. Timber Supply Determinations and Inventory Issues** It seems that most of these issues follow a good description of the land base (VRI Phase 1 and Phase 2). Haven't they become inventory issues because funding has not been there rather than because of deficiencies in the basic inventory? **5. ABCFP Resource Inventory Review** Having two separate initiatives going on is probably good but also much work will be duplicated. Not sure if the general consensus of the ABCFP respondents meant that are serious problems with the inventory methodology or just a serious lack of inventory work being done. **3.2 Vegetation Inventory** **6. Genesis of the VRI** First VRI pilot project was Fraser TSA (1993-96). A key point here is that the VRI was **'a statistically sound inventory standard'.** **7. Defining the VRI**

Also key point is **'at a strategic, management unit level'.** At the end of all this IPR, MOFR must determine the unit level or application of the next round of the provincial vegetation inventory program.

8. How much, Where is it, How does it change

This is a good summary of activities that Inventory Branch is responsible for. Definitely support the need for increased staffing and expertise at the Branch level.

9 & 10. VRI Supports Management Unit Level/Spatially Explicit

The VRI provides the vehicle for describing a great deal of forest cover attributes at the polygon level or stand level including species composition, age and height of first two species, crown closure, stand structure, density, basal area, site index. The key is how well has it been photo interpreted and how has it been adjusted.

With the significant decrease in funding for VRI work in recent years, the quality of the final VRI product may have suffered for several reasons.

a) There has been less classification or calibration fieldwork done by the photo interpreters to assist them in their final attribute interpretations. Classifiers should and would like to do more Phase 1 fieldwork then has been funded in recent years.

b) Phase 1 prices have fallen to an all-time low because there have been too few projects to bid on. Contractors may have been cutting corners to stay in business. In the past 4 years, many have gone out of business or have ceased doing VRI mapping.

c) Phase 2 sampling has not been fully completed in most units.

d) The design of the Phase 2 sampling system may be fundamentally wrong. Key attributes of the main forest inventory types are adjusted on a TSA wide basis not on an individual photo interpreter basis. Some TSAs have had over 15 interpreters involved having a wide range of ability and local photo interpretation experience. How can a few Phase 2 samples in a widely occurring forest inventory type be used to statistically adjust that type for an entire TSA if in that unit it occurs on a wide range of slopes, aspects and elevations and has been interpreted by several different classifiers? Perhaps less information should be collected during Phase 2 sampling but for many more polygons.

11. VRI Timeframe

Agree with the timing comments but funding needs to be in place to complete an entire unit once it has started. This has not been the case in recently (some examples are: Ft. Nelson, Dawson Creek, Mackenzie, Kamloops, Lakes/Morice, and Okanagan TSAs). Completing the inventory of a TSA over many years by several different companies and interpreters will result in an inconsistent VRI. Many TSAs have has some VRI work done in them but never completed.

12. Lifecycle

Correction, the inventory cycle was in effect since the 1960's but dropped in 1980. No unit inventories were done from 1980-87 until the re-inventory program was started in 1988. The VRI program was phased in from 1995-98 to take over the re-inventory program. However, there has been no inventory cycle to speak of since 1980.

13. Site Index

More direction is required on site index or productivity. The terms top height, stand height and site height have gone around and around in circles. Consequently, photo interpreters are somewhat confused on what trees to sample during classification ground calls, what height to estimate during classification air calls and what height to photo interpret during final polygon attributing. May not also been enough understanding by or attention given by the interpreters when assigning site index to young stands.

14. Vegetation Monitoring

Agree that this area needs direction.

15. Young Stands

The key here is the VRI system does provide the mechanism to describe young stands very well. However, I agree that the implementation may have been wrong. The silviculture survey information should be used by the interpreters as a guide only to assign attributes to free growing polygons. Phase 1 contractors should be encouraged (and funded) to establish more multi-point ground call in young stands in order to provide good information.

16. Current VRI Coverage

Agree that forest inventories should once again be the legislated responsibility of MOFR. Funding to carry out this responsibility must be consistently provided.

Agree that government and industry inventory expertise has been reduced to 'endangered species' levels. So low, that it may be difficult to find enough people that understand and appreciate the current VRI system let alone re-design it.

17. Timber Emphasis

The cost and benefits of current Phase II sampling need to be determined along with

	affordable alternatives. **18. Volume and Decay** Is there enough expertise left in government to carry out an effective V&D/NVAF function? Certainly the 100,000 historic tree records must be utilized. **19. OAFs** The common question might be: '*What are OAFs?*' **3.3 Growth & Yield** **20-23 G&Y** Given the current reality, there is no easy solution here. Hopefully enough funds will be made available to properly assess the G&Y need and to develop an on-going program. **3.4 Related Inventories** **24-24. NFI and TEM** As stated, many of the NFI standards were adapted from BC's VRI model and the two inventories are quite compatible. Both ecological mapping and bio-terrain mapping have been integrated with VRI mapping by some forest companies. For those who have taken the initiative, the attributes or detail of the VRI Phase 1 system have proven to be very useful in PEM and wildlife habitat/capability mapping. The beauty of the VRI system is that it was originally planned by experts to be integrated with many other types of resource mapping. The downfall is that it has never been properly utilized by the many groups that were involved in its design.
P20	All is clear.
P21	Background #3: More clarification is needed on how the IPR ties into, or complements, the MPB Area Inventory and Monitoring Action Plan. The 'Scope' section states that the IPR will include "vegetation information specific to management of the MPB". This suggests that there may be overlap/duplication with the work described as being done for the MPB Area Inventory.
P23	3) MPB inventory and monitoring: need a methodology to identify stands with advanced regeneration in it need the guts and or legislation to keep logging companies out of these area for mid term timber supply. 8) I have heard of satellites being used for forest more accurate inventories in other countries; have we looked at this technology? 15) How are we dealing with the 10 to 20 year old stands that have been attacked by MPB?

	16) b) Legislative and policy "Freedom to Manage and Professional Reliance". If we have lost and are losing our working knowledge of inventory does the ABCFP really understand the needs of the provincial, landscape and stand level inventory or do we cut until it is gone? See part 'c'. 20) G&Y; So where are the managed stand programs? Where is the mixed wood modeling? How about climate change? Post MPB model? And associated mid term and long term timber supply models? 24) Related inventories; Can we add to the NFI and create a Provincial/TSA timber supply model and forget about the landscape- stand level inventories? Can we legislate the landscape and lower level stand inventories to the licensees? Can we assign their associated risks?
P24	9. The longevity (change in accuracy over time) of an adjustment has never been tested. I find this comment to be almost amusing. Adjustments are done at a point in time to reflect the changes in either inventory attributes height and age sometime species as well as required adjustment to yield models, if any. Most adjustments are of inventory attributes to deal with the consistent errors from either new or original photo interpretations that have projected for yield changes. 10. **VRI as a spatially explicit inventory.** VRI was never intended to be spatially explicit. The desire of timber supply modellers to believe that it is or to ignore its short comings does not make an inventory spatial explicit. One of the most significant dis-services done to the inventory by timber supply modellers to mis-utilize the inventory in spatially explicit models, 'blocking models'. 12. ...it was planned that the entire province would be covered on a cycle of about 10 years. This is not so! There was never any intention to enter into a ten year cycle. The objective was to complete the installation of new VRI inventories in management units that need information to that level and then to maintain those inventories through an update program, a yield projection program and a monitoring program by revisiting the phase II samples. Any new inventory activity would be clients needs driven and with rare exception would be focused on particular strata. The work on soft copy technology in the late 90's was an early investigation of this technology as a tool to maintain existing inventory coverages while manipulating the strata of interest. 14 Government has not articulated a clear business driver for monitoring at the management unit level, hence there are no Resource Information Standards Committee (RISC)-approved provincial vegetation monitoring protocols in place...... Not so. Unless they have been withdrawn there were approved Change Monitoring Inventory standards in place. See previous comment. 16. Competition for funding: many other resource information needs now compete for the scarce funding that historically was targeted at the forest cover inventory. This may be how it appears but it was never the case. Through out the 90's funding for the vegetation inventory program remained isolated from other funding envelops. As new funding sources were generated like CRII (Corporate Resource Inventory Initiative), these funds by and large went to other inventories to try and bring them up to the level of the Forest Inventory. The real funding problem started with the decision of the government of the day to 'balance the budget by transfer base funding programs to FRBC. Once that happened everyone's goose was cooked in short order! 18. This section is superficial at best and self serving at worst. We now know that the V&D data base for sample gathered prior to the 90's was by and large biased and non representative of the population. Since the early 90's every V&D study, all of which

	used a statistically unbiased sampling frame, has found that the old V&D estimated over estimate the amount of decay by as much as 100%. Let's not use this as a plea to maintain this program or its samples. The NVAF replaces this old dog and the recent announcement by Revenue Branch of the adoption of CGNF for revenue cruising on the coast is the correct decision. 19. **Operational Adjustment Factors (OAFs).** A clear need for a monitoring program using phase II like plots. ***3.3 Growth & Yield*** Much of what is called growth and yield is only yield. Many of the models utilized in the inventory deal with changes in attribute quantum and the new resultant volume. As far as I am aware, the only inventory model that has been implement that has a growth, species change over time, is Prognosis which has had limited implementation. One wonders with the majority of BC forest stands whether the issue of growth is important. Clearly in IDF stands and the hardwood/softwood stands of the Peace, this maybe of importance but the majority of forest stands will not experience a change in species composition unless under the intervention of a catastrophic change.
P25	As part of the background – I'm not sure if it was missed or overlooked on purpose – there was no mention of the Inventory Audits which were conducted in the late 1990's – to put an accuracy perspective on the inventory. These were good to note the shortcomings and strengths in the inventories that existed for a MU. Sorry, I hadn't had a chance to read this document all the way through (still haven't) and I know the March 29th deadline is over, but I'm not sure when I will get a moment to get to the rest of the document so wanted to just send this minor one off now, then when I get a chance again -soon - I will provide any other comments I have then...
P29	I think the background statements do a good job of articulating the problems and challenges. Generally speaking I think many of the implementation issues have come through a rigidity of process and a need to have "Inventory data" fit existing models needs. The inventory design allows for considerable flexibility and processes to accommodate many of concerns. Much of this has been suggested and discussed. Perhaps the review will provide another opportunity.
P30	17. There is nothing wrong that most of the samples are timber emphasis. It shows that there is not a lot of use in the way the eco portion was designed. The timber side was designed to adjust the photo dataset. What was the eco side designed to do? You can't use it to adjust anything, because there is no dataset to adjust. 19. What are OAFs doing with VRI? They are a planning tool, not part of inventory.

P31	The information isn't confusing, but it's an example of how diverse the skill sets are and how many different persons are controlling the data. This justifies the need for a strategy, and why they need to be working together towards a common vision – goal.
P32	I believe you got the Request No. titles mixed up, as the points above call for feedback on background statements, so the following are comments related to the background statements… 2. From an oil and gas perspective, we need an improved inventory of northeast stands so we can determine timber volumes and vegetation cover without expensive and unnecessary appraisals and/or studies. We need a way to monitor impacts and performance (eg. Rehabilitation success). 3. Big changes expected in inventory over next few years as a result of beetle activity, so there's a need to update information continually into the near future. 14. What about all the old forest industry G and Y data (MB and BCFP on coast, Weyerhaeuser, etc. in interior); can't we use that data? 16. OGC focus should be to inventory stands in the northeast and improve information so we can refine our planning and our stumpage charges. 17. Timber emphasis is understood, given limited resources; OGC agrees that this is critical inventory information, but would encourage VRI to consider including non-timer resources in inventory updates where these are considered as important as or more critical than timber information (eg. biodiversity or habitat or cover values for areas of high recreation or wildlife interest).
P33	Interesting historical material in the background. The expected outcomes have not been articulated in this section. This is our task I expect. Clear direction and **vision** could come from the Chief Forester.
P35	8b: The original concept of VRI included sub-sampling phase 2 samples using within polygon variation (WPV) sampling. What happened to this sample, and what is the impact of not sampling for variation when adjusting inventories? 8c: States that NVAF requires that phase 2 samples have been installed, but a concurrent sampling method exists that doesn't require pre-installation of phase 2 samples. The NVAF process is increasingly important, as it will replace DWB factors (excepting breakage) for coastal call grade appraisal cruising. 16a (or perhaps 16d): The combined cost of full-phase VRI contributes to a lack of VRI investment, as discussed at MSRM/TFL inventory meeting, October 2003.
P36	Section 3.1 2.b.TSA level index maps – consider extending to include GR (Genetic Resource) inventories (genetic source/seed use/genetic gain) to support TSR (G&Y models) 2.c. suggest you inform broader stakeholders of outcomes of business process mapping; was not notified beforehand

	3. TIB working on spatially explicit GR mapping (seed deployment / genetic gain reporting) 4. Only recently (this week) came across "Review of Inventory Issues Identified in Timber Supply Review AAC Rationales", Jan 2006 TIB was not given opportunity to provide input / review; genetic gain assumptions are a not adequately modeled / applied inconsistently in TSR / linkages to inventory update process not in place; **Section 3.2** 8. g. TIPSY models genetic gains for some species; spatially explicit adjustment factors may not be adequately validated, or considered at all? 14. consider monitoring data for use in checking G&Y model outputs based on genetic gains; monitoring genetic diversity indicators over time? 15. sampling of young stands wrt timber volume & genetic gains? 19. OAFs – have seen use of OAF adjustments to consider genetic gains **Section 3.3** 21. requires updating wrt genetic gain assumptions and timber volume estimates; genetic gains are routinely considered in base case and sensitivity analyses to support AAC rationales – initiated in TSR2, routine in TSR3
P37	Who will take ownership of this context especially what lays outside of the legislative framework or mandates that we exist in – this ownership question may raise barriers to achieving the expected outcomes.
P38	There were no critical info or perspectives on the Background that were confusing to me. All seemed clear. I think that you've done a good job in including all of the relevant issues. I think that issue 23 – current reality is key. PSP remeasurement is critical in helping to determine how forests develop and change over time, especially in mixed species stands.
P40	3.1 Tight emphasis of MoFR's concerns and initiatives, what about Ecosystem Based Management (Central & North Coast LRMP), SARA, biodiversity, watershed concerns in the MPB, Criteria & Indicators / SOF reporting, etc.? 3.2, #19 VRI coverage - BC-wide issues require BC-wide information, this is a primary concern for many VRI users. 3.4 Related inventories – Would suggest that provincial road and land use inventories are also relevant.
P41	9. The VRI needs to re-affirm its purpose. It was designed to be rolled up for strategic level reporting, not stand level. If this is still the case, the inventory needs to focus on that objective and not try to be everything to everyone. This brings up the question as to why the inventory adjustments are being applied by polygon and not by strata? If the overall objective of the inventory is to be accurate at the strategic level, polygon level accuracies are not guaranteed and therefore the adjusted polygon values are extremely questionable. There is a very large danger of adjusting individual polygons based on strata level adjustment values which could make individual

	polygon values worse than the original interpreted value. And the worse part is you won't know. 16. Section 4 should be added back in to the Ministry of Forests Act.
P42	I take exception to the continued reference to "Timber Emphasis" (item 17). Collecting all kinds of inventory information may be nice, but the fact is that trees, their vertical (tree size) and horizontal (clumpiness) distribution and their species composition is germane to almost every forest resource management decision we make. Most certainly these attributes are things over which we have the most direct control or alternatively are the things that we are most concerned about when we are not controlling them (e.g. effects of natural disturbance agents such as fire and bark beetles or for that matter tree and stand development patterns through growth and mortality due to competition). Of course there are indeed other inventories (particularly aquatic resources and access) that are of equal importance, but to simply label plots established for the purpose of measuring trees as having a timber bias suggests that we could do a better job of managing the forest by focusing on other aspects of the inventory. That is very far from the truth. It is implicit in the comments made that the inventory is not really designed as a system; rather it is a set of components that are constantly being re-rationalized. So for example, we designed a new VRI inventory with Phase I and II components, but we failed to consider from the outset how this information was going to be updated. How will we account for changes in shrub components or course woody debris for example? Where is the system of plots needed to check forecasts of such changes against realities and make adjustments? An inventory is not an inventory if it does not have these features. We need to think about the inventory as though it is part of what we must do routinely and to a consistent set of standards – it is not something that is to be started and then kind of figured out as we go. Building and maintaining inventories should be viewed as being operational to the same degree as cruising or cutblock layout and harvesting for example. The perspective offered in this section is of the pieces rather than the whole and that is a big part of the problem. In terms of the growth and yield program there is some history that warrants mentioning. The growth and yield program was established as a stand alone program, initially for the purpose of producing "normalized yield" tables which today is described in terms of VDYP. These plots were established according to a matrix in "well stocked stands" and so are in no way representative of a population of stands such as those that occur in the inventory. So the fact is that while we have a substantial number of growth and yield plots, another set of plots is needed for forest growth and mortality monitoring. The growth and yield section does not discuss the development of models and their use in relation to the inventory to any great extent and yet growth and yield modeling is a vital component of managing and maintaining inventories. It can be argued that yield models are insufficient to address many kinds of forest management issues, and growth models that do not take account of actual stand structures (tree species and size distributions) are unrealistic. Growth and mortality modeling deserves much more attention than was given in the discussion document (this also relates to the use of height over age curves, site index and assessments of forest productivity).

P44	8a. Accuracy of the Phase 1 is suspect by the industry. The VRI Branch continues to indicate that the use of VRI is a strategic tool yet the industry and MOFR continue to drill down a product that should be used with reliance off information at the MU level (i.e., 1:2,000,000 scale) yet the application of land use decisions / compliance with landscape unit planning drills down the Phase 1 to 1:20,000 or even 1:10,000. The industry is suspect as ages and heights are often non operational when the MOFR staff assume the VRI is best information available and there are huge known gaps in the attribute reliability. 8a. Photos to be used for future VRI should be 1:15,000 8b Addresses the reliability of the VRI for MU level decision . it Works . Better that the confusion over Phase 1 9. Weakness in the system exists where VRI for a MU management decision based on minimal field observations leadings to inaccurate stand level attributes yet MOF District level expects to use VRI Phase 1 polygons to evaluate the reporting of impacts on LU objectives. 10 .....polygon – specific level may likely be unreliable ... 11. Gov't incentives through increased AAC / mitigate AAC to get industry partnerships through IFPAs can move the progress forward 12. Ground sampling for Site index at the Site series level is not possible based on 15 ground plots per mapsheet 13. Where is the business plan for PSPs to be re-measured.....industry has little interest to delivering on Government's responsibility to shape yield curves on TSA landbases. 16. Defined Forest Area concept has proven successful in the MU's with IFPAs and in TFLs. In both cases the Licensees have an incentive to manage for the AAC for the MU. Provide such incentives across the province where any increases will be awarded to the participating industry licensees, will likely lead to further progress in VRI. 17 What is the ROI of ecosystem plots? There is none under an IFPA is in place and any uplifts are allocated to the participating IFPA holder. 22. Industry has seen little value on TSA's to do PSPs 25. TEM is too expensive. PEM has been adopted to identify increases on Long Term Harvest Level and as such increases in AAC by active Licensees. Funding was available and industry (IFPA holder) rose to the challenge to do PEM as there seemed to be an incentive to secure increases in AAC by doing so
P44	Expected Outcomes: 1. well-formulated recommendations for a clear, comprehensive mandate, mission statement, and vision for the VRI program. Also, evaluation of options and recommendations for effective program delivery over the long term which identify roles and responsibilities of the various participants. 2. recognition of the serious succession problems which will soon occur. At least 50% of remaining gov't inventory staff will retire over the next 5 years taking their knowledge and expertise with them. A similar situation will also affect the private sector. The ability to bring in new staff and provide the training they will need can only happen if there is an active field component of the program. Learning the business only happens by "doing" the work, it cannot be done by sitting someone in front of a computer screen. The loss of remaining expertise poses the greatest risk to rebuilding and maintaining a program into the future.

	Background Issues and Events: 1. Lost within the long list of issues and events are an indication of the main causes of the demise of the forest inventory program. Statement #16 discusses some of them, but more accurately they are: i) steadily declining funding for both staffing and delivery of new inventories which started in the FRBC era (1996 onwards) with more and more of the program becoming reliant on "soft" funding; ii) a whittling away of ministry capability to deliver a program which could meet the need for current, reliable inventories; iii) decisions reached through Core Review" in 2001 that gov't would no longer "do" inventories and be left with a minimal role; iv) the creation of MSRM which then failed to understand the importance of a forest inventory program; v) removal of all operational funding. Together these were key factors in crippling a program which was essentially sound and effective. The loss of many trained staff and end of any presence at a district level rendered what was left of the program more or less invisible to the users of the inventory. The downward slide was further compounded by the licencees also "downsizing" their inventory capability, largely focusing on their short-term needs on "their" part of the land base and then hiring consultants to manage this responsibility for them. Lastly, the removal of the legislative mandate under Section 2 of the Forest Act, "The Chief Forester shall develop and maintain an inventory of the forest and lands of the Province", meant that no-one was ultimately responsible or in charge of this function any more and this sent out the message that it was not of much significance to the business of gov't (note that the reference to removal of Section 4 of the Ministry of Forests Act is incorrect; only Section 2 of the Forest Act is relevant here). The overall impact of the above events cannot be overstated as they are root causes of the current crisis!
P45	Issue 8. The VRI process also includes a tool to answer the question how much variation exists in a polygon? WPV sampling was designed to measure or quantify variation within a polygon This type of sampling hasn't ever been implemented however it does exist. This form of sampling will provide valuable data for those who apply the vegetation inventory in an operational context or purpose. Missing from the Review Statements is the Inventory Update Activity. The issue regarding capture of block size resulting from small scale salvage of MPB killed Pl and the frequency of the update for disturbances along with the linkage to Results should be clarified. Under MSRM the Inventory Update Function was centralized from Forest Districts across the province to Kamloops. The District Inventory staff were either moved or removed from the Forest District The local knowledge (Inventory staff) regarding the Resource and Inventory activities within the District was lost. Additionally under reorganization and WFA Forest Districts amalgamated, further compounding the problem creating vast areas to manage with the same or fewer staff.
P47[4]	8d. Money spent on phase two may be better spent on more ground calls to better calibrate the photo interpreter eye. 9. Phase two adjustments have often created more questions for Timber Supply Analysts than answers.

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[4] Delayed Response—received after first compilation

	14 & 15. We log plant trees, track them to about age 15 then essentially ignore then until they are at least 30. Yet in analysis we assume these stands will grow to perfection and (pre-pine beetle at least) this influenced the time period over which existing mature and old growing stock is liquidated. Today approximately 25-30% of the provinces THLB are under 30 years. Post beetle (i.e.: within a decade) that figure will be far higher. In those areas that are not salvaged we will need to inventory what is left, and when and how much regeneration is coming in. 17. Industry does not log CWD. 18. It is probably about time (if not long overdue) that we actually develop and implement a program to derive empirically derived OAFs to apply to TIPSY. Surely we can do better than just knocking 20% off the projected yields.
P48[5]	8a,b,c. How much do we have: We suggest adjustment methodology be added as a separate and important tool / component for answering the question, "How much do we have". 8g. How does it change: Yield projection tools in BC are typically separated between natural and managed stands. 10. VRI as a spatially explicit inventory: This is definitely a key issue from our perspective. 11. Timeframe for completing a VRI: Without a phase 1 in place, one would be unable to initially stratify the ground sampling. Is this referring to some post-stratification system? 13. Site Index: Unclear how the SI adjustment carried on the inventory file is used. We were unaware of this. 14. Vegetation Monitoring: Can we imagine a circumstance where monitoring could lead to an inventory or yield model adjustment? 16. Current VRI Coverage: From the onset, VRI for the entire province was estimated to be a mammoth exercise that would be extremely costly. We expected this performance given requirements associated with an inventory to this standard. We would be interested in comparing this with the cost and timelines for the forest inventories prior to 1996. Is the problem associated with the delivery or is it the standard itself? What did MoFR staff do then that isn't being done now? 17. Timber Emphasis: This does not surprise us at all. Has anyone been able to step up to with the business case for full VRI? We would be interested in knowing who has really used non-timber components of the current inventories available and for what purposes. 18. Volume and Decay: This is confusing. Does this suggest that data associated NVAFs have no application for estimating volume and decay? There has been considerable debate over the appropriateness of previous V&D information. 22. Legacy: Which PSPs are really worth keeping? How many really need to go beyond their typical rotation?

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[5] Delayed Response—received after first compilation

	23. Current Reality: When was the G&Y program well coordinated? What were the conditions? Have alternatives been considered? Are our standard models driving this program? Industry, and We suspect MoFR, is very concerned with how their landbase has diminished and adjusted in recent years. This certainly distracts anyone from looking at long-term monitoring. 24. National Forest Inventory: Indeed, this is where government is best suited. Other: What has been accomplished through the change management process? What training programs are in place? There is a lot of speculation in this document that cannot, we suspect, be supported. This is probably appropriate at this stage, but we should be cautious about making assertions without the back-up.

Input Request 3: Assumption Statements

INPUT REQUEST 3: Please use the separate Feedback Document to provide your feedback (reactions, questions, suggestions) to the Assumption statements.

- What assumptions which require more clarification for you to understand?
- What assumptions do you strongly disagree with?
- What assumptions would you like to add?
- Please refer to the Assumption statements by their number.

P1	A little confused on all the assumptions discussed around the inventory components and the uses of the information in models and the complexity of changing inputs/data. Discussions around seamless inventory and VRI updates. Why can the original VRI model as designed not accomplish these tasks? Not clear from the discussions. There was some discussion on climate change but how does bec/species/climate shift changes impact our current inventory programs/remeasurements/models and assumptions current, short term and long term? Can we react and model predictions in for forest management decisions? PEM and TEM need to be completed in a timely manner to correct standards. OAF adjustments have been calculated from certain IFPAs in the province and are considerably lower than TSR assumptions. Can we extrapolate and model these province wide to incorporate in with the inventory data? Agree with the staffing and funding shortfalls for the inventory programs. Huge management decisions and future conditions of stands are based on our existing information. Need to adequately resource inventory function to ensure most accurate up to date information is available.
P3	We are looking at this from only a Ministry of Forests and Range perspective, which should be opened up. There are other ministries also affecting the data.
P4	2. a. We need to teach users about the reliability of the inventory at a stand level. We need some effective demonstrations to teach the risk of utilizing the inventory in stand level applications. Woodlot inventories and Community Forest Inventories are a case in point. A tiny piece of a management unit inventory is plucked out of the data base and is assumed to be correct. 2. b. iii. Current governance, funding and delivery models combine to create a paradigm that does not support inventory of whole province. A new paradigm is required if we are to achieve this goal. 2. f. This is not just an issue of number of people. The Forest Service needs staff with the right skill set. To get that we require a staffing strategy that includes recruitment, training, and retention.

	6. "This model assumes that where stand level accuracy is critical, additional stand level sampling will occur." The answer to the need for stand level accuracy will not come from sampling. The answer is in Phase I. Improve the estimates through field visitation. 19. PEM is a predictor. It says "what we expect to find there", not "what is there". Unfortunately, users miss that distinction. They believe PEM is "what is there"
P5	I agree with the assumptions statements as a whole and think they are fine as is.
P6	Assumption 3.b) Forest Districts need to have communication about where the inventory lies at the district level, i.e. which BA – Business Area. The assumption is it lies in the Stewardship BA. The question then is: "What is the districts role in inventory?" Or "Will there be a role for the Forest District?" Some concern about Assumption 10), i.e. RISC standards and the LIBC Data Custodian Council. Could not a gentlemen's agreement be put in place to continue with the protocols used by the LIBC Data Custodian Council on a voluntary basis until a formal decision is agreed upon regarding the future looks of a similar council or protocol or…?? Assumption 11) discusses the seamless inventory. Is there a thought to reviving this initiative? Or is it a "fait accompli"? What are the issues created by not completing the seamless inventory? Can we accomplish the desired end result by some other means? Assumption 12) – a great deal of discussion can be generated on this assumption alone. It appears that the funding model has shifted too far to the side of being proponent driven. MoFR or other ministries should ask to be considered as proponents as well. To bring some balance as to where funding is allocated and hopefully fill in the information gaps so that a more complete picture can be provided for any AOI at any time. The issue of better coordination can possibly be provided by developing regional committees involving regional inventory staff, designated district staff and interested licensees to prioritize investment decisions. The regional inventory staff then report back to the VRI Steering Committee with recommendations. Assumptions 20, 21 & 22) – SFM and G&Y, what is envisioned with using G&Y for SFM? Is it a better answer or equal to the monitoring protocol designed a few years ago to be used in conjunction with VRI data? Could the monitoring protocols be designed to feed into the FREP RSM process for biodiversity? Is it useful to provide some communication to MoFR licensees about using G&Y for SFM monitoring? …?!
P7	Assumptions that require clarification: 4(a). What is meant by inventory requirements of forest managers? Are you talking about managers at the operations level, or managers at a more strategic level? 8). What led to the database being so large and complex? Who uses this data and does it have value? 15) How do you see coordination of funding leading to better probability of achieving objectives? Is there this much extra overhead involved?

	Assumptions that I disagree with: 2(a). The inventory should also be implemented for operational use. Decisions made at the stand or watershed level need to be compatible with direction provided at the strategic level. 6). Stand level accuracy is critical for many exercises long before operational cruises and silvicultural prescriptions are available. We routinely conduct analyses at a watershed level to guide how harvesting will proceed in order to meet objectives such as old growth, ungulate winter range, etc. These analyses require confidence in having reasonable stand level data. Operational cruises and/or reccees will not be carried out to collect this information. 12) There are at least two TSAs in the province where FIA has been delivering VRI information so the model can work. VRI has also been delivered successfully on TFLs. I think there is a bigger policy issue here. Inventory projects will be delivered when there is a benefit to the stakeholders. DFAM or area based tenures where there are some benefits to the participants will result in inventories being completed. However, if DFAM is merely a way to offload the administration of a government program without participants receiving benefits or having a say in standards will not yield results. This clearly ties in with assumption 13). Is there something wrong with directing funds to inventory projects that provide a short term benefit? Just because there is a short term benefit to industry doesn't diminish the overall longer term value of the inventory investment. Why does government perceive that a benefit to industry is an undesirable outcome? Assumptions I would add: VRI in its current form does not meet the inventory needs of industry. By this I mean that it does not provide a cost effective product with the accuracy and resolution necessary to make decisions at the level we operate at. We do not need this information just for making decisions about which stands to log to get the products we need. Today's operating environment requires us to undertake spatial analyses at a watershed or landscape unit level to ensure we are meeting all of the non-timber requirements as spelled out by landuse plans or government policy. The data we use must be consistent with the data used at the strategic level. Strategic plans will often set targets for things like old growth – in some cases we cannot achieve these at a landscape unit level because they don't exist on the ground (i.e. the strategic inventory has provided inadequate direction).
P8	Forestry in BC continues to experience unprecedented, new challenges including other industrial uses impacting the forest land base. In the Peace, inventory requirements of forest managers and of the chief forester for AAC determinations are significantly affected by other forest resource values. What is more important is to ensure we're using a common inventory so we can compare and assess costs, benefits and impacts appropriately. I sincerely hope that the IPR will be able to strike a balance between current methods and systems and new approaches and needs. Assumption 8: add oil and gas disturbance to MPB attack, as it has a similar affect

	Assumption 11: gaps in data between different MU's and admin areas such as parks are a big problem. Assumption 12: suggest re-introducing TSA or district-level strategic plans that include inventory, front and center. Assumption 14: begs the question; should the inventory reflect all sources of disturbance or only those created by forestry? Assumption 17: should we be thinking 'all users of the forest' or only forests and environment? Look at the business case – who needs the data to plan and undertake their work? Expand to include IMPR and OGC, and their clients. Assumption 20: need to include mixedwood modeling and management as a driver. Assumption 21: look to NE BC for the reality of multi-stakeholders, overlapping tenures, and the challenge of maintaining G&Y plots. They provide important info to Forests, but their relative importance to other users varies with the type of user. Assumption 22: add oil and gas, other industry to 'd.' . . optimistic that reforestation for oil and gas disturbances will one day become required practice.
P9	Item 10: According to Evert Kenk, RISC is the responsibility of ILMB. He will be looking at the RISC issue in the near future. With the recent changes in government, i.e., the demise of MSRM and Inventories moving back to the MoFR and MoE there is a need to revisit who has the custodial responsibility of specific Inventories. Item 11: We need to look at the notion of getting in all Inventories that licensees hold. As they are operating on crown land, government should have un fettered access to these Inventories. We need to fill in the gaps.
P10	I believe the assumptions provide enough details and for the most part are representative and accurate. #2b (iii) I do not believe it is acceptable to ignore land designations or inoperable areas which is currently being done under the current FIA format. Licensee want to focus on operable areas for verification of data, this does not address non timber values or could apply more pressure on the operable areas for designation of UWR, WHA etc because we have accurate and reliable inventory for this area. #2d-g totally agree with these statements. This is causing poor management decisions, inaccuracy in TSR etc. #8 Yes the dataset is large and requires continuous updating for such things as age and volume. The datasets could be reduced if for example age was replaced by year of establishment, volume is eliminated. These items could be calculated on the fly as required by the user and as a result save data storage. #9 The use of VRI data for stand level decision demonstrates a need to incorporate and link the data to the silviculture data found in RESULTS. With the transfer of data entry to licensees and the inability of MoF to monitor quality of the data RESULTS information is

	questionable and at this point caution must be exercised when using this data. #11 Efforts must be made to get agreement of data sharing with other stakeholders. Under the FIA funding model there is the opportunity to ensure data standards and data capture efficiencies are achieved. This also provides for the ability to share and merge datasets. In addition the FIA funding model may also allow for cost sharing of maintenance and storage. #13 Based on a recent FIA meeting I understand there is now targeted funding for inventory works to be managed out of Region. This could provide a more stable environment for inventory work. However, schedule, availability, and cost of such inventories are expensive and the ability to ensure the entire province achieves the same quality of information in a timely and effective manner is a challenge. New approaches and use of new technologies and techniques should be reviewed and explored. #17 Totally agree, we need to inventory the entire landbase to address all values including timber, wildlife, FN, recreation, mining etc. This potential increases the number of stakeholders (i.e. MoFR, MoTSA, MoE, MoEMR, First Nations, and industry) involved in the process but could also allow for cost sharing and data sharing. #18 This would allow for the opportunity to ensure we are collecting the right data, avoid duplication of collecting data and generate cost and time efficiencies.
P11	2a: Most planners and managers understand the uncertainty of using inventory at the stand level, but it's the only spatial tool widely available. Cost-effective improvements or alternatives for planning purposes are not apparent. 2g: Questionable statement. A lack of government leadership, funding, and support in recent years shouldn't be confused with a lack of inventory expertise or capacity in the private sector. The issue in Appendix 1 regarding consultant capacity and consolidation (page 21, paragraph 5) is an incorrect assumption. The lack of involvement by many existing VRI consultants is caused by concentration of VRI contract management and restrictive bidding opportunities (e.g. select tender) in recent years.
P12	4.1 2 a) this is a critical problem as the information generated for MU level is not meant to answer stand level questions. Quantifying error sources and qualifying estimates with error bars seems appropriate. 4.1 2 g) disagree fairly strongly with at least one aspect of this statement. 4.1 4 In addition to the identified three points it is essential to include in the IPR focus a component on: d) Stakeholder education and knowledge transfer to address the problem of misuse of VRI information. e) Institutional infrastructure and capacity building to handle the VRI and associated linkage programs 4.2 14 The degree of imperfection must be better understood to identify areas where estimates are especially variable 4.2 15 agree – at times different parts of government seem to work against each other making it problematic to implement anything

	4.2 17 agree
P13	4.2 Vegetation Inventory Lack of a Standard regarding shelf life of a Timber or Vegetation Inventory Some very northern parts of the NIR have very old (30+ years) timber inventories. Places like the Liard; Kechika; Sikanni', and the Cassiar were also photointerpreted from 1:40 chain photography. These old inventories are undefendable in my opinion. Although these areas may contain a high proportion of NonTHLB area they are important to First Nations; as Wildlife habitat; contain potential for mineral exploration; oil and gas activities. 11. Agreement with the statement regarding differences between TFL and TSA inventories. Unless TFL and TSAs use the same standards, there will exist an inability or a problem to merge data between the two Management units. Data compatibility problems aggravate data analysis for First Nation and wildlife habitat issues that cross administrative boundaries. The situation is somewhat similar for Parks and Protected Areas adjacent to TSAs. Who is responsible for conducting the VRI over these Areas? Some very large Parks and Protected Areas exist receiving no funding for VRI inventory. This issue is also number 6 under Critical Questions 12 & 13 There is a need for setting provincial or at least Regional priorities for VRI. Vast areas exist with very old inventories which aren't being addressed for VRI. The current FIA model using a business logic favors new inventory over THLB at the expense of the nonTHLB. A true Provincial Program would identify gaps and deficiencies and look to find a way how to address the deficiencies.
P14	4.1.2.a to g In the TSAs I deal with (Mid-Coast to Hope) I do not think all these statements are reflective of reality. Of the 7 TSAs I deal with 5 have VRIs either completed or actively implemented. While FAIB hasn't been directly engaged in the decision process, contrary to their perception, there is no restriction to their participation. Every few months there are regular meetings between industry, BCTS and local provincial government and FAIB personnel are welcome to attend. If they have a capacity issue then they should deal with it – but don't blame the whole process. For the other 2 TSAs one has a G&Y SIA project being implemented (Arrowsmith) and the other (Mid-Coast) should benefit from the change of the FIA funding model to an AAC basis. The old model was based on direct harvesting activity and the Mid-Coast, with CCLRMP and "Great Bear" restrictions, would lose out on funding. At the risk of being rude I find this whole section a bit self-serving to FAIBs perceived needs and does not reflect what is really going on, at least in my region. 4.1.2.b.ii This item laments the fact that only 500 of 4500 plots had the 'full suite' of 'designed' attributes collected. The other side of the coin is that if only full plots were established probably only 2000 plots may be implemented because of the substantial increased cost of the full plot attributing. Extra time is needed to collect 'full' information on the plots usually

requiring repeat visits to the same location on different days. This is a fantastically expensive proposition when you factor in helicopter and crew-day costs – especially on the coast.

More fundamentally, are these extra attributes really useful? When I discuss this with other individuals involved in ecosystem and habitat supply modeling they feel the sampling is far too light for what they need and there are important gaps that make the information not too useful (e.g. Shrub information is not too useful to habitat modelers unless the species of shrub, not included in the VRI, is collected too).

4.1.3.c

I understand that when the VRI was being designed a range of beneficiaries (mostly government) of the vegetation side of the attributes were invited to participate. As the designing went on many of these participants dropped out or lost interest in completing the final design work. Maybe its time to reevaluate the usefulness of the extra attributes in light of this and the fact the TEM seems to be more useful for habitat and ecological processes. I believe this is an important statement.

4.1.3.d

I feel the use of VRI in business decisions is one of the most important issues here.

4.1.4 a, b & c

I can't stress the importance of focusing on the content of the latter 2 statements (inventory requirements for other values and have progressive improvements). Sometimes I think blinders are put on in this justification for TSR needs only.

4.1.5

This assumption starts out well but the "too disruptive and too expensive" statement makes it look like how FAIB may presuppose reaction to change proposals.

4.2.6 & 7

Scale should not be thought-of so statically. I think it should be more thought-of as a first step. Point 6 is the first step and point 7 is a way to get to succeeding – better information. The adjustment of the VRI after Phase 2 and NVAF should not be looked-on as the last steps. The information should continue to evolve.

4.2. 8 & 10

Mostly internal FAIB issues that FAIB has to deal with.

4.2.9

A strategic inventory it may well be in the beginning but, with some forward thinking, it could evolve to something else over time.

4.2.11

Our company's position is that if the government want to make our information freely available then it should pay for our share of the collection of the VRI data (unless we get direction from our executive to do otherwise). The inventory was done under FRBC and we had provided the 60% of funding that was required at the time.

Woodlots, small private holdings, small and medium sized parks are generally inventoried for VRI under LBIR. Larger parks could be considered if a case is made at the LBIR meetings. FAIB should actively seek out the meetings and attend – they are not, and never have been, restricted from attending.

4.2.12

While some programs (like growth & yield) have fallen off and do need a regional and/or provincial strategy, I do not think this is the case with VRI (see my comment above 4.1.2.a to g). On the south coast the Mid Coast TSA is the only special case not having the inventory work it desperately needs. The new AAC-based funding model, however, should start to help this situation.

4.2.13

I'm think statements like this (LBIR funds only directed to short term benefits and "uplifts") just confirms the bias I think exists in FAIB. At all the LBIR meetings I attend (which FAIB people can attend too and district MoFR employees usually do) most participants at these meetings just want better information to do sustainable forestry! Sometimes there are uplifts and sometimes there are downward pressures - but better bases inventories (VRI & TEM) are wanted by all.

4.2.15

While I can agree that a coordinated rationalized plan is needed on a regional and provincial basis for Growth & Yield, for VRI, which is a standard inventory, most work is being covered off within the LBIR / DFAM groups. That is where I think it should stay except for some tweaking of group membership.

4.2.17 - 19

I know there are always moves afoot to combine VRI & TEM for more perceived efficiency and decrease cost. While ideally this is an attractive goal, there is a danger, however, that this can lead to too much compromise on the part of the professionals doing the work. When I interview the ecologists and VRI classifiers establishing these inventories whoever is second to the photo, and forced to work with the first's linework, always laments the compromise they feel they have to make in doing their interpretations.

Also there is a danger in trying to automate inventory collection too much. In one recent attempt on the coast called ssPEM I compared a TEM on our TFL with ssPEM over the same area I found a 20% agreement rate for 1st decile site series. Also second and third decile site series, which I believe PEM type inventories have the most trouble with, are quite often what is wanted by wildlife habitat and ecological professionals.

4.3 In General

I agree with most of the statements here except for the statement "licensees do not have an incentive to make long term G&Y goals". Most industry is under some sort of forest certification these days (SFI, FSC, etc) and by definition must adhere to sustainable forestry concepts that include G&Y.

I do agree, however, that regional and provincial participation in G&Y programs is a necessity.

P15	• Section 4.1 o 2-b-(ii) – VRI Phase 2 may have been designed to collect attributes other than timber but the fact that only 10% have done so leads to the question around business value. This information is not accurate at the photo interpretation stage and augmenting the information with a few ground samples over a large area (i.e. TSA) does not seem to make business sense. If this data is truly important it would have been collected. o 2-c – Industry and Government business drivers are not completely aligned. This process needs to clearly identify what each parties "business" is. o 2-e – Capacity issue is also a factor of un-realistic standards and expectations. o 2-f – Inventory personnel's perceived tasks need to be challenged and clearly defined in this process. See comment for 2-c. o 2-g – The statement around "work that government wants to have delegated" needs to be understood. Is that "want" a true need? o 3-b – ". . . inventory related roles and responsibilities" truly need to be understood. o 3-c – ". . . test and re-affirm" should be replaced with "challenge" o 3-e – These key areas need to be fully supported by stakeholders. Stakeholders also need to be defined. Using the inventory periodically for one use may not warrant expensive additions to the program, which in the long run, will not be sustainable. • Section 4.2 o 6 – The examples of additional stand level sampling that would occur where stand level accuracy is critical do not assist the inventory in any way. In today's business environment, the data collected in these sampling techniques is gone in a very short period of time (usually harvested) and do not lend well to updating and inventory. o 7 – This option needs to be explored further. o 17 – This is an honorable approach, but it can not be at the expense of timely, sub-strategic level accuracy.
P16	2a. Planners and managers are often aware of the uncertainties in using the inventory below the management unit level but what is the alternative? No decision? Again, most decisions are made well below the MU level and this will only become more prevalent as time goes on. We are going spatial, how are you going to respond? 3a Who uses the VRI at the MU level? The latest timber supply analysis for the 100 mile TSA track individual polygons so are you really meeting the Chief Foresters needs. I think Timber Supply Review requires accuracy well below the Management unit level now. 3c. It is time to re-affirm all assumptions with regard to the VRI, particularly the utility of Phase 2 sampling and the adjustment procedures. 6. Why not use cruise information to adjust the VRI. Am I to assume that 50 polygons extrapolated to one million is more reliable? 22. What about GY and post beetle growth expectations. This is going to get real important.

P18	4.1 (2)(a): I disagree somewhat with this statement. In general, where stand-level analysis is occurring, more detailed stand information has been collected either through cruises, photographs or silviculture records. However, VRI **is** being used for spatial analysis at the landscape unit and drainage level, and this may be inappropriate based on its sampling but what options do planners have? 4.1 (2)(b): I have a concern that VRI was created to be a one-stop inventory, in its effort "to collect a suite of vegetation attributes". In many instances, what has happened is there is not a business driver nor money to collect all this information so only the "timber emphasis" information is collected. Perhaps the reality is that VRI cannot do a suitable job collecting enough ecological and wildlife information to negate the need for these other inventory sampling programs. Combining efforts would be efficient but only if we can use the data and from what I have seen this is not the case. 4.1 (4): Strongly agree with the IPR focus statement. 4.2 (7): If "local" information was ever planned to be incorporated into the VRI dataset, it was not documented in a readily accessible place. 4.2 (11): A provincially seamless database may never be possible as changing formats and data structures is not an expense that TFL holders wish to incur often and certainly not external to their control. I have been involved in a TFL which followed provincial VRI standards and have had nothing but confusion and limited support on it (with the exception of some of the wonderful local MOFR Inventory personnel who tried their best to help). 4.2 (17): I disagree that VRI should be holistic. I think that VRI is one component of a holistic approach. VRI should be what it is, one inventory. Overall: It is very evident that the province (government & industry) has lost a lot of expertise in inventory and growth & yield. This will be difficult to address without one organizational body taking up the lead, and I would suggest that will likely have to be government as it has been identified that industry is driven by short-term targets.
P19	**4.1 Inventory Program Review** **2. 'Inventory staff feel that important improvements can be made to the inventory program'** a. - this really emphasizes how good the current VRI (Phase 1) really is.....that is, it is being used for even more than it was designed to be used for! b through g. - all of this section merely laments that there hasn't been enough funding to carry out the VRI program as designed. **3. Overarching Assumptions** a. The VRI was designed for much more than just AAC determinations. b. A review has to be made of the existing inventory expertise within the newly formed

FAIB. In order to develop a new and improved inventory program, MOFR will have to hire some inventory experts.

e. Appendix 1 provides a good insight into the real issues caused by lack of government funding that is required to keep a purposeful inventory program going. Each needs to be addressed in the next stage of this review.

4 & 5. IPR Focus and Aim

Commendable but again, where is the expertise in government to do this?

4.2 Vegetation Inventory

Comments

Phase 1 – The current Phase 1 involves delineation, classification fieldwork, polygon attributing and digital mapping. The delineation and attributing standards and specifications of VRI were designed by a Classification Team (subgroup of Vegetation Inventory Working Group) made up of a team of many professional inventory foresters, ecologists, geologists, pedologists, wildlife biologists as well as range and recreation specialists. Consequently, the current delineation and polygon attributes of VRI are very sound for a vegetation inventory. Actually, the BC VRI attributes are very close to the Alberta AVI system and a combination of the VRI and AVI have been copied by Saskatchewan, Manitoba, Yukon and NWT for their vegetation inventory systems.

The only question with the Phase 1 attributes is if they are all necessary or are some additional ones needed. The current attribute system could be very easily modified by simply turning off some fields or by adding a couple of additional fields. In this way all of the manuals, standards and specifications could be quickly updated. New data entry and editing software would not have to be completely re-written and newly interpreted maps would be 'compatible' with the existing VRI maps.

Phase 1 Fieldwork – the current classification air call and ground call procedures are good.

Spatial Accuracy – all VRI mapping is done on TRIM base maps to TRIM digital mapping standards and is definitely accurate enough for VRI.

Phase 2 – Similarly, Phase 2 was designed by a Sampling Team (another subgroup of VIWG) made up of many forest inventory and sampling specialists. However, Phase 2 has always been questioned: Does it really work properly to adjust and validate Phase 1 and is it worth the expense?

Growth and Yield – G&Y is a very specialized field and expertise within government is almost all gone. Red flag here is to develop a highly experienced G&Y team in FAIB. This team will need work closely with forest companies, universities, federal government and neighboring provinces and states.

P20	2Biii, 11 - information gaps in TFLs, PPA, and Private land impact the use of VRI information for strategic analysis, reporting and decisions. 2Biv - licensees who have opted to allocate public funds to inventory rather that other investment opportunities should not be penalized is government comes in to address the gaps. 17 strongly support. There are efficiencies to be realized in the phase 1 of VRI by strongly linking the delineation and identification of present vegetation map units to the more permanent and causal factors represented by physical features (topography, terrain and soils) and biological features (ecosystems, i.e., site potential) 18. An aspect of ecosystem inventory that needs to be strengthened is the characterization of succession pathways for commercially important or frequently disturbed site series; (both natural and managed succession) Add assumption: Remote sensing technology is maturing (including satellite and airborne sensors) and should figure prominently as a third phase (or new first phase) approach to vegetation inventory
P21	Assumption 17. Clarification is needed around the phrase 'holistic terms' and this assumption overall. Assumption 12. Needs to be clarification around the comment that "poor overall coordination has caused inconsistent investment decisions" under the FIA delivery model. Using FIA to fund forest inventories could work if enough base funding is available for a longer term, and if some portion of the funding could be targeted at the MU level rather than individual licensees. The FIA weakness is that there is little incentive for licensees to use their own allocated funding to collaborate with other licensees on MU or regional -level projects. Funding decisions under FIA are up to the individual licensee, they must "use the funding or lose" and having it tied to stumpage/AAC encourages them to spend on their own short-term interests. If one or two licensees are championing an MU level project, they may eventually abandon the idea if other licensees don't come on board because they believe that non-subscribers should not benefit from the product(s) without sharing the costs.
P23	2) Can we change the cruise methodology and mandate the use of technology to get results accurate enough to verify or actually supo0rt the inventory program? See the above comments on the ABCFP and the lack of inventory knowledge. 12) "FIA Land Base Investment Program …is ineffective.. you summarized all of the past and current programs, lets not repeat our mistakes. 16) Once again where is the Managed stand and the MPB impacted stand information. 19) I think that you should redesign the inventory around the PEM - TEM idea. As listed in your discussion a lot of work has been done in this area and a lot more will be done in this area as we deal more with SARA and other values.

P24

Before starting this section we should question the role of government in maintaining the forest inventory of the province. Reading through this document including the appendices, it appear that staff wish to return past and become the sole arbiters of when and how inventory gets done. They wish to do so in spite of their diminished capacity due to previous downsizing decision and current and soon to be retirements of key staff.

The role for government in the future should be to maintain the definition standards such as top height, dbh, species id's etc but not the procedures. They must develop the capability to integrate data from well documented models into either their own data repositories or create a logical data repositories through the linking of many data holders to provide an integrated picture for a web client.

The control of how should no longer be their purview nor should they be the sole arbiter. The paper has argued to continue and strengthen this role. From personal observation, I have witnessed extensive delays caused by this process. In one case as much as 6 weeks added to seeking permission to proceed. The project only took four weeks to complete and as the project was nearing conclusion bureaucratic ineptitude took over requiring the sanitation of documents to meet funding rules.

The bottom line, get staff out of approval of process. Get them solidly onto maintenance of definition standards, data models and create the ability to integrate data from well documented data models into their data sets or create a logical view of that environment for a web client.

i. The inventory was designed assuming all components would be completed on each management unit. This is not the design. The design was referred to as a tool box with clients specifying their business needs and then utilizing the appropriate tools from the box. At the very least, my expectation was that the Phase II plots would be installed so that the existing photo interpreted inventory could be adjusted.

iv. The Timber Supply Rationales from the Chief Forester indicate a continuing trend of the investment model in not responding adequately to his vegetation inventory concerns. This is clearly not acceptable, but who is accountable for remediation? Actually this is not the case. If you review the Terje Vold paper "Review of Inventory Issues Identified in Timber Supply Rationales, January 13, 2006. Prepared for John Wakelin you will find that site productivity is the most significant issue of concern of the Chief. Clearly there is a call for Phase II inventories in the Prince George, Quesnel, Kamloops, Merritt & Mackenzie TSA and Phase 1 on the Okanagan, 100 Mile, Merritt & TFLs 46 & 47. The question is clearly rhetorical, the Chief has the responsibility.

We shouldn't forget how we got to this point. In the 80's TSA steering committees were charged with managing and to a large extent doing TSRs. In many cases, some time for the right reason & sometimes to delay the process, these committees pursued perfect information to feed the linear programs of the day. As a result TSRs were not completed. In the early 90's the then RSM of Forestry from the Cariboo region, one Larry Pedersen and Darryl Errico, undertook a review of the TSR process and the rest is history.

The major change in this period was to move from a calculation of an AAC to a determination of an AAC by the Chief forester with the Chief assuming the responsibility to deal with imperfect information. Through the use of sensitivity analysis and other techniques the variability in the quality and of the information to inform the TSR process has been well handled. Ultimately, if the Chief is not satisfied with the state of an inventory, he is the only one that also has the ability to alter the situation.

f. There are too few government personnel to fully carry out the custodial responsibilities they are tasked with. Is it custodial responsibility or is it process control. These are different. It is my sense that custodians are trying to manage their custodial responsibility by managing the process used to capture and manage the information rather than focus on the definition and data model aspects of their business.

7. The original designers of the VRI envisioned the ability for local "new" information to be used to adjustment the inventory[3]. However this feature has not been accommodated in the existing design. I don't understand this comment? Clearly existing or new Phase II information can be integrated into the existing phase I estimate. What is the problem?

14. For many reasons, managers in all parts of the sector must rely on less than perfect inventory information. However, there does not appear to be a minimum quality standard that must be achieved before a decision-maker can consider it. While this situation can be rationalized as being in the best short term interests of the public, it begs the question: Is it in the public's long term interest and if not, what minimum standard must we achieve and by when? See my comments on iv.

15. If all sources of Provincial and Federal Government and industry funding for inventory and G&Y activities were rationalized, coordinated and planned cooperatively there is a greater probability of achieving the quality objectives of the inventory users. Governance and delivery activities should involve major providers of inventory and G&Y information, with direct or indirect means for participation by stakeholders. I really don't see this happening. Unless the FS moves to mandatory DFAM for all volume based tenure holders what is the interest of these tenure holders in participating. In most cases they no longer posses staff with inventory experience. The only real time we have had industry engagement in a process like this was during the Section 88 days when committees actually allocated funding to projects. So is this really a plea to return to the days of an HQ delivered program?

20. Our claims to sustainability rest on our ability to predict future forest values under alternate management regimes. Not so. Our claims about sustainability rest on our ability to demonstrate that we in fact are sustainable. Predicting future forest values is about establishing a range of future possible baselines. Determining sustainability is about monitoring those predicted future conditions and comparing them to a predicted sustainable baseline.

	The rest of this section argues that we need G&Y and PSP sample plots lets go back and do more. My answer is plots by all means but monitoring plots established in a statistically unbiased fashion such that measurements and remeasurements from those plots will talk to state and rate of change of variables of interest. That is about sustainability.
P26	I think I agree with most of the assumptions outlined, but don't know if the language needs to be stronger to emphasize the need for more government control of where when and how much VRI will cost. Assumption # 2 - c: I would suggest that in some case where Licensees are running VRI Photo Interp. Projects, they are expecting a local level of accuracy in the Inventory that they will not get using traditional costs for VRI and in some cases may become disillusioned to the value of a VRI because of this or pour more money into field work and still not improve the VRI at a local level. Assumption # 2 – d: Under the current funding model, Licensees look after what meets their needs first and in some cases VRI may not be considered at all. Funding must consider the needs of all and not just a few. Assumption # 2 – e, f, g: These 3 assumptions are very correct. But potential utilization of government VRI staff in the right areas; prior zing VRI and directing licensees and contractors could be improved.
P29	It is not just global competition that is at stake – it is global participation. I am not sure why it is an inventory "problem" that planners do not understand the limitations of inventory information for operational planning. Perhaps a shift in responsibility and accountability. The issue of incomplete phase I estimates should not be a surprise given that the process sums up stand attributes to the total rather than simply estimating the total and allowing the user to distribute that "policy" total as they see fit. This was recognized as a significant weakness in a structured 2 phase inventory. The assumptions in this section are well considered and accurate. It is apparent that the authors concerns are in line with the intent of the original VRI design and recommendations.
P30	2.b.ii. The VRI was designed so that the eco and timber could be done independently. There is no issue with not doing the eco data collection. 2c… Maybe govt needs should be more aligned with the needs of industry. 2e.f.g… there are definitely capacity concerns in the consulting community. 3d… There is nothing we can do about that except educate the users about the limitations of the data. People will continue to use it this way because it is the only dataset of its kind. There is nothing else to use that is this good, and this cheap. 12… Seems to be getting better.

	14… Inventory information will always be less than perfect. It is based on estimation and sampling. it will never be perfect. But again... it is the best we have. 17… How do we do this?
P31	We are looking at this from only a Ministry of Forests and Range perspective, which should be opened up. There are other ministries also affecting the data. Correct, - The FIA model of funding doesn't work well for have stability in the work force completing the tasks because it is an annual program. These projects are longer term.
P32	Do we need and can we afford to include a full suite of data? Timber is the most significant factor, so let's make sure we keep that up to a usable standard for now. The multi-resource inventory should only be done where justified by intensive use or high resource values. We should focus on areas of current and planned future activity so we get the most out of our efforts. Considering the relative value of forage/cover/biodiversity, the case for non-timber inventory in the northeast is stronger than for the rest of the province. 12. FIA funding is too variable. We need stable funding and regularly scheduled updates. Industry should be required to contribute as the information supports their activities. 21. Agree with need for non-even-aged g and y information.
P33	There are a lot of assumptions here. Outside of the VRI am not aware of a Provincial Inventory Program although I am aware of numerous initiatives. These assumptions seem to apply to all the initiatives.
P35	2a: Most planners and managers understand the uncertainty of using inventory at the stand level, but it's the only spatial tool widely available. Cost-effective improvements or alternatives for planning purposes are not apparent. 2g: Questionable statement. A lack of government leadership, funding, and support in recent years shouldn't be confused with a lack of inventory expertise or capacity in the private sector. The issue in Appendix 1 regarding consultant capacity and consolidation (page 21, paragraph 5) is an incorrect assumption. The lack of involvement by many existing VRI consultants is caused by concentration of VRI contract management and restrictive bidding opportunities (e.g. select tender) in recent years.
P36	**4.1** 1. stakeholders with tree improvement investments also want to market TI products – wood quality, growth form, pest resistance… 2. agree; uncertainty wrt genetic gain assumptions; report roll-ups 3. a. and 4. a thru c. require new VRI / genetic source/gain linkages to provide CF decision support in TSR, FFE, CC, MPB,… 4.2 9. and 10. new and /or emerging stakeholders currently need to be brought into loop

	4.3 14. minimum stds not in place for G&Y modeling of genetic gains 22. add – tree improvement investment decisions 22. d, e, f - seed use, genetic gains; h. genetic diversity j. SPAR
P37	Under item 21 – it seems that besides variable retention and EBM (as well as partial cutting), we are not only looking at complex stand conditions, but also complex species conditions as well (mixed species stands (including various conifer mixes as well as conifer/deciduous mixes)) Under item 22 – there have been many perceived drivers identified – but the issue has always been the lack of a linkage to key decision making processes that have a direct impact on land manage practices and eventually – industries bottom line. We have never been able to link taking care of the inventory on a public landbase to those having the licenses on that landbase. It is a challenge and will always be a challenge if this linkage between the inventory (what our future supply will be) and how we take care and monitor what we are doing to it over the long run (other than viewing the management as a legal liability) is not made. Within the existing political framework this linkage is even more fragile.
P38	▪ none ▪ I don't disagree with any of your assumptions ▪ None to add ▪ I strongly agree with your assumptions 2c and 2d and agree with assumptions 18, 19 and 20. ▪ I also very strongly agree with assumption 21. This is critical, especially in light of the current MPB infestation as is mentioned in this assumption.

P40	4.1.4 (a.) seems to suggest a timber focus, while (b.) mentions "other forest and resource values". Why the separation? Given the requirements of modern forest management shouldn't we be envisioning an inventory that meets both requirements?
P41	Agree with all the assumptions.
P42	I strongly agree that model based projections such as PEM (19) are useful in building inventories in the first place, but the system should promote the use of operationally collected data for the purpose of making ground-level updates. I agree with 17, but what does this really mean. It means that we have a series of classifications that can be used to describe the resource that are reliable and stable over the long term. We have a significant issue with SIBEC since this was constructed on the basis of representing Climax Forests and since the plots used to build the classification were themselves subjectively located leaving much of the variety of ecosystems unexplained (i.e. we took a platonic point of view). Furthermore, not enough attention has been given to soils and soil series mapping which is critical to many forest management decisions and modeling frameworks, and is in fact the ultimate forest resource. So while SIBEC has been extremely useful in raising consciousness of ecosystems and their management, it is a limited concept in a changing world – particularly one undergoing rapid global warming. This simply underlines the need for longer term monitoring plots, use of models to extrapolate from known locations to unknown locations in the inventory using related sources of information, and the need to formalize the updating of this information through operational data collection mechanisms. My own bias is as follows: We need to integrate tree-level kinds of information (back – we used to have stand and stock table information in the 70's albeit it was not at the level of precision that we need to underwrite the various kinds of forest and stand management decisions we are making today) into the inventory, since the biggest decision that we continue to be concerned about are which trees to cut and which stands, when, versus which ones to leave behind. This is true both at the strategic and operational levels of detail. Our strategic level plans do not give adequate guidance on this front and as a result such plans are out of step with operational realities. Inventories need this higher level of detail, also as the basis for making growth, mortality and ingress forecasts since we seek to influence these processes through silviculture and harvesting practices. Such details need to be supported by the establishment of plots that can be relied upon to monitor growth, mortality and ingress over the longer term, so that we can update the inventory in such a way that it is reasonably consistent with reality.
P43	2a. Plan to fund more access to height and age of samples trees and operational cruise plots to strengthen the attribute files of the VRI. Operational cruise plots have be data mined in the Okanagan for $2 a tree. 2bii. What is the incentive for industry to get involved when the TSR uplifts are allocated at the direction of the Minister....a weakness of DFAM model 2bii. SIBEC...Why has the samples by Site Series increased from 4 samples to 7 samples thus increasing the cost of the project by 175%

2bii There appears to be concerns of get ecosystem data at time of VRI, is this ecosystem data truly needed?

2biii. Who pays for delineation of Private lands when FIA $$$ do not cover this.

2e. MOF Inventory downsizing is not the only reason there is a capacity issue, aging workforce and attrition is accounting for a lot of this.

2g. …and the MOF does? Provide the funding to do the work and it will create a demand and job will be created with industry and constants.

4. What AAC strategies or ground rules are needed to extend info at appropriate scale to provide GIS data at stand level???

5. Talk to FIA

11. Fix the eligibility criteria through FIA funding.

12 This can be resolved by providing incentives to make private public partnerships

13. and are supported by a strong business case

14. Who know?

15.

16. Agree

17. At what scale 1:20,000??

18. Why has SIBEC sample intensity increased from 4 per Site series to 7 per site series

19. No here is a loaded gun. I have heard so many complaints about the accuracy of computer generated contour maps at an operational level. Now PEM is being automated on TRIM at $0.06 per ha and based on limited field verification. While the system works fast, it is a product that can only be used properly at the MU level. (i.e., Caribou) I expect some significant problems coming out of this when trying to use it to balance CCLUP land use usage accounts

21. Province is the land owner and the province should do G&Y on TSA as the steward of the forest.

22. Agreed

23. The government has lost many VRI practitioners largely to attrition and retirements. OR

Non available contracts as during the period 1990 – 1995 the low bid contracting system forced many practitioners out of province just to get work.

P44	One assumption that is missing is that developing and maintaining inventories is a long term undertaking and thus responsibility must reside with those who understand the need to plan and manage publicly owned forests for the long term. Forest inventories have a life span of at least 15 to 20 years. The forest industry, especially on the coast, is presently engaged in a massive restructuring, with huge shifts in tenure, buy-outs, sell-offs and disappearance of long time players. This is reflected in a continuing decline in industry capability to handle inventory matters. This situation of "tenure musical chairs " will continue for perhaps the next 10 years and bring a host of new tenure holders to the scene. Many of these will be smaller tenures such as community forests, and most of the tenure holders will have no inventory knowledge or capacity. Gov't is the only entity that is here for the long term and can protect the public's interests in its forests. Elsewhere, the attempt to place responsibility with a special interest group, i.e. licencees, has completely failed. The B.C. experience of privatizing the forest inventory function is proving to be no different.
P45	2d. Provincially the TSAs that will not likely see investment in a VRI could be identified. In addition there are some very large Forest Districts (Ft. Nelson, Cassiar, Mackenzie) that are problematic in attaining border to border complete coverage in a timely manner. 2. The VRI process and design doesn't work well for small area based management units such as woodlots and community forests. 13. Disagree with statement. There are cases but generally the bulk of Inventory funding has been directed to VRI without AAC uplift bias but rather to promote improved resource stewardship. This has been my experience. 2 b iv. The issue of identifying who is responsible (mandate question) for conducting and maintaining the inventory on Crown Lands on TSAs; Parks; PAs should be written in legislation. By answering the mandate question accountability can be assigned to the appropriate body. If it decided that it's the government mandate to carry-out and maintain the inventory, it would enable change to roles and responsibilities, staffing levels; delivery of services to occur within the Program much quicker. 22. Mixed wood growth modeling is overlooked as a business driver for G&Y.
P46	4.1.2a – so what can be done? I don't think you can expect to control how your data/information will be used; you can only expect influence the user. Two solutions: 1) better inform your users (educate); 2) new inventory so that it is suitable for analysis at the stand level (I do not think this is feasible given the resources required for such an undertaking). The simple solution here is extension/communication with users. 4.1.2bi – what are the risks associated with only phase 1 complete? This obviously meets industry so are there options to completing phase 2? Maybe adopt an accuracy assessment program (would this be anymore cost effective?)?

4.1.2bii – maybe this suggests too much is required? Should the inventory truly aim to collect information for multiple needs or should it rather use a tool box approach where users can select from standard suite of attributes.

4.1.2biii – the current status does work for some users, partial coverage still allows for estimation and analysis of certain attributes. However if the true intent of the inventory is to capture info irrespective of ownership, **and for multiple users,** than no, this is not acceptable. Bottom line question which needs to be addressed is "who is this inventory serving?"

4.1.2c – the business needs of government and industry will never be aligned but there will always be some level of common ground. The same can be said for government reorganization and industry consolidation, the problem will never go away. Maybe the best way to address this is to use the middle ground between the needs of the two to solidify the core of the program. Having a solid, balanced program core, that is understood and the meets the needs of all involved, will reduce the impacts of the ever changing personnel.

4.1.2d – so what? What is the risk? What is the business case for the unit in question? There is obviously a business driver lacking here…why invest in something that is not going to be used?

4a and b – why are the inventory requirements of forest managers and of the chief forester listed separate from the inventory requirements for management of other resource values? This is crux of the problem…inventory is inventory? Why is there a division between forestry needs and those of other resource values? There needs to be a shift in thinking here if we truly want to change the way the inventory program works. It shouldn't be about forests first.

4.1.5 – I find the following statement:

"Some approaches to improving the program may be too disruptive or too expensive to be implemented."

to be a significant statement in that it suggests there are limits to the degree of change that will be allowed. If you are not willing to accept that change may involve flipping something upside down and inside out than I don't think you are truly open to change? The "too expensive" statement I can agree with as you can tie this to a business case analysis.

4.2.10 – "….data custodians are no longer bound by that decision" but they should still use the RISC procedures for standards creation and maintenance as they represent an accepted, proven process. I'm not entirely sure what the intent of this assumption statement was but in my mind why move away from a process that worked?

4.2.12 – where is this ineffective statement coming from? Some background here would be useful to support such a claim.

4.2.13 – true but they do have some long term benefit to other users and could be made more useful if additional funds were made available to support additional work. Could a separate pot of money (like the current FIA inventory pot - $7mil) be used to top up inventory projects in order that more complete inventories get done (this may be how this

	money is being used, I'm not sure)? This way the "funding recipients" can continue to direct their inventory projects towards short term goals and gov't could direct additional funds towards making the inventory more complete, and ultimately valuable for a greater number of users. 4.2.17 – yes 4.2.18 – yes New assumption – what about the BEC program? Inventory in BC relies heavily on the BEC system. The inventory program can only succeed if the BEC program is sufficiently maintained and supported. Currently there are many challenges and unanswered questions facing the BEC program including: climate change – how will these change the system?- local knowledge and expertise – succession mgt?, limited resources, etc… So I think there is an assumption being made in this document that the BEC system will continue to supported and enhanced in such a way to allow the inventory program to succeed.
P47[6]	2a. Inventory staff have not done a good job in communicating the strengths and weaknesses on a particular inventory in a particular unit. A globally accessible website (well advertised) to convey such information and further, how the inventory has evolved and changed over time (and why) would be very useful. 2bii. Again industry was not convinced the benefit to them in collecting the full suit of attributes was worth the additional cost. 2biii. I suspect only government would only be interested in collecting information within protected areas. Further, from a timber supply prospective we are only concerned with the extent, age and health of forest within parks, not the dimensions of the trees. 2 f and g. You cannot pretend to regulate/manage a resource you know little about. Put responsibility for inventory back in the forest act. Consultants would still collect the data but inventory specialists should know the basic inventory and growth statistics by unit. Better still, that summary information could be posted on a website. Answering questions like "how much cedar is there on the coast?" would then be relatively straight forward. 4.2.11. Perhaps a seamless inventory of a small subset of critical attributes could be achieved but I'm not sure a seamless full (all attributes) VRI inventory across parks and TFLs is worth the expense. 4.3. GY under a partial overstorey will become really important post MPB epidemic. Once inventoried we will need to be able to project subsequent regeneration and residual stand structure. But perhaps more important than this GY effort will be describing what is there post MPB.

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[6] Delayed Response—received after first compilation

P48[7]	Clarification needed: 2biv. What's meant by "his vegetation inventory concerns"? TSRs are done every 5 to 10 years. 2c. We feel that the most important area in this process is for government to clearly define its business needs. 2g. What work does government want delegated to the private sector? Typically the private sector responds to the expertise or capacity that is requested. So what's the issue? 3c. This is way too general. What assumptions need to be tested and re-affirmed? Disagree with aspects of these assumptions: 1. First, I'm not convinced that the situation today was much different from when the VRI was developed except the MoF Inventory Audits identified certain weaknesses with inventories at that time. Second, we must not charge ahead in addressing these perceived challenges without preparing the business cases for doing so. Government must decide whether they really want to manage the forest sector because that will require investment that this industry can no longer afford to contribute towards. 2bii. It appears to us that the vegetation attributes in addition to timber do not have utility and should be removed. Soils and ecology are better reflected in TEM and TSM. There are too many variables and uncertainty with wildlife needs to identify the types of vegetation attributes to classify. Wildlife habitat models are based on features we have only begun to consider – many of which cannot be identified from an aerial photograph. This just points out that these attributes are better obtained elsewhere. 2biii. The NFI should be the mechanism for reporting out on the provincial forest (otherwise it should be scrapped). VRI was always targeted at management units. Whoever had the idea of patching this together for the entire province should stand up and explain why. 2d. It's better to be last. Yet again, licensees and districts that directed their scarce funding allocations towards inventories in the past will be penalized if current funding is redirected towards those who elected to spend their money on other projects. Meanwhile others take a back seat. Assuming funding decisions were made on a priority basis, 30% of the province felt over the past few years, that VRI was not important enough or too costly to undertake. That means that 70% did! Try not to forget that. The FIA delivery model goes a long way to resolve this trend, but we fear that players coming into the game late are trying to change that.

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[7] Delayed Response—received after first compilation

2f. Why is it assumed that only government personnel can carry out these custodial responsibilities?

2g. Who is suggesting that industry and consulting does not have the expertise? What is this based on?

3d. The current inventory is not designed to support business decisions but we have no choice if it's the standard that's in place. The inventory can be retrofitted with another model that does support business decisions but most likely for the industry involved, not government. Plus, policy changes could facilitate this further (e.g., appraisal cruising) but government is too fixed on its own needs.

3e. We only made it as far as looking over the issues identified by FAIB staff (Appendix 1), became discouraged and stopped. This IPR just seems to be the vehicle for FAIB staff to regroup and launch its ideas for a new direction. We are not entirely convinced that industry presence or comment will influence this process but we need to be involved. Again, our involvement will only be recognized as another stakeholder at the table when in reality, WE are the forest managers and data custodians.

4. Is the forest inventory really a significant issue with recent TSRs?

11. Why do we need a seamless inventory for the entire province? What province-wide assessments are being contemplated? What issues would arise from that approach?

12. We feel strongly that the FIA delivery model is effective at both the management unit and regional level. Government's failure has been in describing its regional and provincial strategies along with business drivers that provide incentives.

It disturbs us that people forget that prior to VRI, inventories were in dire need of attention with little done about it for many years. Government then brought in an extremely expensive inventory standard that even then would have required hundreds of millions of dollars to implement. We feel progress towards full provincial coverage, if that was indeed the target, has been going very well considering the challenges the forest sector faced. The FIA delivery model has directed funds appropriately to the areas the required it.

13. …and here we understood that AAC uplifts (all long-term) were good for everyone in the province.

Other:

I'm concerned that the money spent on this initiative to design a better mousetrap could be better spent conducting an inventory somewhere.

Input Request 4: Critical Questions

INPUT REQUEST 4:	**Please provide your feedback (answers, reactions, further questions, suggestions) to the critical questions.** ▪ What other questions would you to raise? ▪ ? Please refer to the Questions by their number.
P1	The forest health question. Current pest outbreaks and disease outbreaks across all age class and biogeo zones. Will this increase in the future, how does our existing inventory of plantations compound or add to the problem due to management decisions? Delivery model. Centralized/regional centers or at the district level.
P3	Where are the persons trained going to find work to apply their new skills? Is there work out there? and money to enable it to be completed? A strategy is a great idea; and fundamental to what meet your challenge, but funds will be needed to implement it. If there are no funds the strategy and any effort to train persons will be lost. The feedback form is very limiting. There was no discussion on Barriers to moving forward, Substitutes, Strengths, Opportunities or Weakness that should be considered. This might be a more effective way of opening up the discussion. Eg. Focus on your strengths, reduce your weakness.
P5	1) Yes. A review is appropriate and necessary. I agree it needs to be linked to G &Y. This review will be worthwhile if the new information provided is more accurate and up to date than the existing data. 2) It would be nice to know the age of the data we are working with. I.e. how old is it? When was it last updated? Protection needs a simple method for providing digital data (shapefiles) to Inventory branch for updating existing data bases. In return Protection needs timely Inventory information-sps, vol/ha, $$/ha. 3) Well, I hope it's not 5 years away but in the future I would like to see a fully automated real-time system that takes a shapefile (fire perimeter) and sends that shapefile to the appropriate forest cover/veg map. The shapefile then interrogates that map and provides information such as damages to timber by species, volume and $$ to all land managers that need this information. History records would also be updated automatically. This is similar to what I typed for question 2 but I will assume that for question 2 the process would not yet be automated as I am hoping for here. 4) No comment. 5) I think it important that there be one central depository for all Inventory information, both crown and private. It could be updated by different users (government and licensees) as long as similar standards are adhered to and qualified staff do the updating. One stop shopping would be nice. The LRDW was/is a good idea; it just seems like all the data didn't hasn't made it there yet. The data that is there is very difficult to navigate through to get to what you want as some of the naming conventions for maps/folders make no sense to a forest tech like me. 6) Yes. Kinda ties in with what I typed for question #5

	7) As far as the protection programs needs goes for accuracy, I'm sure they'll be met as other users of the inventory data will have a need for a higher degree of accuracy then would protection. I would expect as a minimum that accuracy would improve from what is currently out there. 8) No. See comments for question #5. 9) No comment. I don't know enough about this. 10) See question #3 11) I think that the inventory information has huge value. I believe there is a lot of skepticism around the accuracy of the data. I don't think we're extracting full value from the inventory data. Protection would benefit huge from an up to date and accurate data base that has been built based on the latest technology. Inventory needs to be more than just a data base. It needs to link and work with other systems out there in a way that provides for real time information. Inventory is important for proper fire mgmt planning, fire sciences and fire behavior, fire reporting of damages, fuel mgmt, prescribed fire planning and for Protections geomatics program. **12)** No comment
P6	General concerns: The most critical need is to have a better grasp of impacts on the forested resource and THLB by other programs or activities, e.g.) O&G activities in Northeastern BC. [This will be started in April, 2006.] Another critical issue has to do with knowledge concerning mixed wood forests/stands. Granted, there probably is a greater need for targeted research first. But, there does appear to be a dearth of information available for TSR purposes?! Question 11) the value and purpose of inventory information appears to be quite mis-understood. It appears that many people inside gov't still consider the [VRI] inventory an operational inventory when it is not. It is an inventory to be used for planning purposes. Stand level cruises are an example of an operational inventory. More communication is needed about this on a more regular basis. Probably directed to the level of a lay person for ease of explanation between different groups within the forestry community and outside...! General thought/question for all of us: "How do district staff, in particular new to MoFR staff, access inventory data in a one or two stop shop sort of process...?! In other words, how or where do we inventory contacts in the district direct staff, colleagues and other ministries to – to easily find data?" I don't see any region links to inventory websites...? There are a few district webpages - and of course Branch. And iMap. ...?!

P7

1) Yes, the review is appropriate. The scope could possibly be expanded to include related inventory projects such as PEM or MPB updates since there may be synergies to be gained from looking at everything as a package. I would finish the sentence as "This review will be worthwhile if an action plan is developed to streamline the inventory program provide cost effective, relevant information for all aspects of forest management, including issues at an operational scale.

2) The top expectations from the inventory are:

   - be able to provide data that can be used reliably for more than strategic AAC applications (i.e. be more operational)
   - be able to provide better information about expected timber attributes such as piece size, quality, etc.
   - provide reliable projections for future wood supply (i.e. AAC) in areas that will be heavily impacted by MPB, considering different management options that may exist.

   An additional expectation that I believe is worthwhile is the need to account for forest health factors. What are the volume projections for mixed stands where the pine has died out? What is the regeneration delay and impacts on future stand yields for pine stands that die and are not harvested/reforested right away? What are the impacts on current and future stand volumes in root rot infested stands?

3) Some things that I believe the inventory must be able to address in the future include projections for biodiversity, habitat, hydrology and other non-timber values. This will be critical in adjusting to "life after beetle" and still being able to operate.

4) The most critical requirement now is to have an inventory that meets our day to day needs as well as serving the strategic AAC function. We need to have reliable typing, as well as predictions of size, quality, and species composition. Predictions of future stand volumes & profile for different management options is another critical component. The ability to generate reliable, watershed level estimates for use in planning is also a priority.

5) The lack of sufficient detail to allow for spatial planning at a localized level is a serious data gap.

6) The inventory program should include TFLs, Parks, and private land provided that the intent is not to download the funding for this onto industry. There should be a minimum standard for these lands that the data would be provided in. Additional data would remain proprietary.

7) I would expect sufficient accuracy that we could count on it for planning purposes when assessing plans at a watershed level. For example, the age, species composition, and volume should not be grossly different for a stand than what the inventory indicates. An inventory that indicates a stand as Fd when it is in reality spruce is not acceptable. We must be able to guide operational plans with the inventory data so that they can be rationalized against strategic plans, and have value to our business. Metadata that could help would be a statement of confidence relative to a specified attribute at different scales: e.g. volume accurate to +/- 5% at TSA level, +/- 10% at watershed, and +/- 15% for an individual stand.

8) No comment. I believe it is easy to access, but my own personal access is through an in-house database. The database structure is such that it is difficult for non-technical people to use it.

9) This depends on the tenure system. Funding should be provided by government since it is a public resource. I believe coordination at a local level is possible through processes such as IFPAs, etc. There is more probability of the inventory being useful to industry if it is coordinated locally.

10) I would like to see improvement to the accuracy to allow it to be used at a level other than strategic. I don't believe it is capitalizing on new technology appropriately. There was an opportunity to use new technology by licensees for mapping MPB under DFAM. However, the program was not allowed because it did not meet the RISC standards. It is unfortunate, because it would have been a cost effective way to collect the necessary information regarding MPB infestation levels, as well as providing a tool for operational use. As far as providing funding, it will ultimately come down to providing some form of area based tenure with some security attached. We should only embrace new technology if it is cost effective and gives better results.

11) I don't believe we are extracting the full value out of the inventory. I also don't believe there is a strong business case for the inventory in its current form, unless we can address some of the shortcomings such as updating non-timber attributes following harvest and silviculture, providing data that can be used in spatial models, etc.

12) No comment.

13) *Inventory needs and business drivers:* Is it necessary for district staff to be intimately familiar with the inventory? Under FRPA, they will have less need to be looking at the inventory on a regular basis.

Inventory program planning and delivery model (options): Why is FAIB increasingly uncomfortable with data quality? There are standards in place and the contracts require data assurance. Is there evidence that the system is not working with respect to quality? If so, this should be dealt with through the associations that govern the practice of the professionals signing off the data assurance. With respect to the concern that funding is being diverted to other priorities: If funding is being diverted, then either the funding available is not adequate, or the inventory is not providing value when compared with the other projects. I am concerned that this statement implies that inventory should be funded off the top with no concern for what else falls off the plate. I am particularly concerned that this is another attempt to download more onto licencees. Government must be prepared to provide adequate funding for "their" resource.

Inventory Capacity. I find it troubling that you believe having government employees complete the work would be more cost effective than having consultants complete the work. If there is a sizable inventory program in place, it will attract more consultants and there will still be competition. With respect to the statement about VRI focusing on core timber values: I don't believe it has been shown yet that the additional attributes are providing the necessary value to justify the additional expense. If the value was there, then they would be collected. These non-timber attributes must be able to be updated and projected along with timber values if they are to be of any continued use beyond the year in which the inventory was completed.

	14) Additional points: ▪ I believe the VRI standard needs revisiting so that we can get the information we need with more accuracy. I am concerned we currently have a Cadillac inventory standard without the resources to support it. As a result, we may be unintentionally creating a substandard product to what we could accomplish if the standard were revised to reflect reality. ▪ Where does inventory fit within the overall priorities for land based activities? We all agree inventory is important, but so are other activities. I get the sense from working through this challenge that FAIB is trying to ensure funding of the inventory program at the expense of other programs. There needs to be a balance. Either funding needs to be increased to meet the requirements that government envisions, or the program needs to
P8	Item 5: consider multiple stakeholders, overlapping tenures, and what this implies for content, attribution, and frequency of updates. Item 6: not an easy question since different uses, different scales mean different business drivers, perhaps different standards, update cycles, etc. Item 7: consider including in metadata information that states reliability by scale. Item 8: info access is reasonably good providing the info exists. For oil and gas data, is a problem. Item 9: inventory activities don't appear to be coordinated at the appropriate level/scale. For forest inventory, MoFR should be responsible to manage VRI, and ILMB to warehouse, both to fund, and depending on inventory in question (whether it is oil and gas disturbances or forest harvesting), the respective regulating agency should conduct/maintain the inventory info. Item 10: consider using satellite images for updates. Districts could provide some limited ground sample verification. Collectively, should have the resources and ability to support new technology. Is worth the investment. Item 11: no, don't believe we're extracting full value from the inventory. Item 12: Capacity issue is presently large. Item 13, Appendix 1: ▪ Business drivers will come and go, but what is the long-term future vision for inventory? ▪ Need strategic planning, including inventory, at the district level. Licensee priorities are not necessarily shared. ▪ If eco info is collected, will it not be for strategic level uses? Still need inventory reliability to support more operational multi-stand level uses. ▪ Agree, for some geographic areas such as the Peace, it is important to verify AUM allocations as sustainable. ▪ For many areas in the Forest Service, succession planning will be a challenge.

	▪ Standards for oil and gas are not covered presently. As a first step, perhaps capture the information corporately, examine user standards, and determine what info is important to retain and how it will be incorporated in/with VRI. Page 23: totally agree with the statement concerning data management.
P9	6. Yes, The provincial VRI should include all lands in the province irrespective of ownership and tenure. Inventory should be done to the same standards and at the same level as a current VRI over a TSA. 8. Information access should be free for all inventories and data on the LRDW. We need to look at the cost/benefit of fees for information compared to the revenue that government receives. 9. I don't think that current model is adequate. It relies on licensee interest to determine if an inventory is conducted or not. If it is in the best interest of the licensee then an inventory is considered. Licensee interest does mean in the public interest. The current delivery model is flawed. FIA in its current form does not allow for coordination of inventories across the province. Government need to have that role in determining where inventory activity should be taking place be government is suppose to act in the best interest of the public. 10. Currently it is difficult to look at innovation as it is necessary to have the right qualified staff and the budget to look at this technology to determine where it is appropriate to incorporate within data collection standards. Over the last fours years we have not been given the opportunity nor the funds to look at new innovative technology. If innovation is important to government then it must be appropriately resourced. I would support innovation if we have the appropriate resources to initiate, and review and implement as appropriate innovative ideas. 12. Yes there are significant inventory capacity and succession issues. Recent downsizing has hurt current VRI staff in that a large amount of intellectual knowledge has left. Inventory capacity also has been affected because much of the expertise has moved out of the province because of the lack of inventory work over the last 4 years. Training is also an issue. Government currently doesn't put on training. On the RISC website (http://ilmbwww.gov.bc.ca/risc/training.htm) it states: *On July 19th, 2004, the Forestry Continuing Studies Network (FCSN) announced that it is no longer providing training related services in the resource information business area.* *At this time, the most prevalent model has the ad hoc market presenting a demand on qualified trainers to provide RISC approved training leading to government certification of trainees.* *In order for the province to provide for quality, control and consistency in the data collection and analysis involved in the inventory, the provincial Resources and Information and Standards Committee (RISC) has developed standards and procedures, specifications and methodology for the various*

	aspects of the inventory. *Trainers are invited to use Ministry training material and conduct training courses to qualify* individuals for employment in the inventory initiative. The Ministry will not pay for the training courses but the trainer is permitted to recoup the costs of training through fees charged for the training course. Trainers will need to secure access to RISC training materials and the approval of the appropriate data custodians to meet this market demand. Trainers must demonstrate to the data custodian that they are qualified to train individuals. This has not resulted in a whole lot of training recently.
P10	• Consistency between private sector and government on data collection, standards. May require the reestablishment of RIC, or a body that ensures consistency of data collection, data format, storage and data structure • Scheduling of data capture between TFL and TSA to capture efficiencies and ensure above standards are achieved. Need to address standards regarding acceptable age of the data – how old can the data be before it becomes unreliable. Are there levels of reliability based on age, amount of disturbance, etc • Why is the expectation only focused on VIR and not other data sets such as wildlife, TRIM, PEM, TEM, historical information, Soil inventory • What about the data management – garbage in garbage out, who will be responsible for data quality control and how will this be achieved • Would like to see improved access and ability to incorporate TFL and TSA datasets together for landscape level analysis • What is the status of TIPSY, TASS, TIPSYEconomy, updates and changes recommended in the TASS/TIPSY Topics For Review... June 2002. • Accessibility to data for new partners – easy exchange of data, improved data compatibility. • Metadata – need to ensure this provides the necessary information and is accurate. Build into framework, assuming new people and a lot of people will be using it we need consistent structure to the Metadata form, and quality documentation. • Technology and Flexibility – we need to be flexible to our approach, ensuring easy access and compatibility with outside sources (i.e. earthgoogle) • Data Storage, the north is not being adequately served by the LRDW, a local data service centre similar to the Bulkley Valley Model may be appropriate to establish within each District or Region. • How will all this fit with the bigger data management strategy for MOF – i.e. avoiding duplication of data, ensuring information from one database can be linked easily to another to avoid duplication of data entry and reduce errors and inconsistency in the information.

	▪ Ability to merge data in a seamless database at all scales. The data is not only important at the Provincial Level but is also important at the District level on a day to day basis. ▪ Ability to capture multi-layer data, for example mixed wood inventories ▪ Require District involvement to field test across programs. Need to ensure data is easily accessed and staff, other agencies or outside groups are able to generate both spatial and tabular reports when needed to address local issues around strategic planning, resource stewardship monitoring, silviculture, forest health, C&E etc
P11	1: There are links to other programs that have not been addressed, including the overlap of standards, training capacity, and certification of MOFR CGNF appraisal cruising and the evolving role of the (ASTT) Forest Measurements Registration Board. 9: Conducting inventories should remain where capacity exists: consultants. The MOFR should have a bigger hand in managing the inventory (e.g. setting priorities, etc.), including contract management standards (e.g. open bidding) to ensure an appropriately sized and competitive capacity is maintained in the province. 12: Depending on outcome of review, phase 1 training, and phase 2 ecology sampling capacity is lacking immediately. 13 (Appendix 1 Comments): Missing linkage to MOFR coastal appraisal cruising (CGNF standards, NVAF replacing DWB factors). Inventory capacity and succession challenges are bigger than competing with other jurisdictions or planning for retirements. The looming demographic problem of retirements is intersecting with a downward trend of forestry graduates. The Foresters Act now includes RFTs, and that has increased demand for educated and experienced technologists throughout the industry. VRI photo interpretation and sampling specialists are usually the most experienced of the technical community, and these people will be in high demand by many employers outside of inventory. Consistent, long-term funding of VRI is the only way to maintain capacity in government, industry, and consultants. Corporate memory and specialized knowledge aren't the same thing, nor are they exclusive to companies or government. Program memory, including specialized knowledge and limited corporate memory, exists in individuals in all three sectors of forestry. Down-sizing in one sector (e.g. gov't) usually leads to a build-up of capacity in another (e.g. consulting), and vice-versa. Government inventory is definitely understaffed, but care should be taken that a build-up in capacity for support and monitoring doesn't come at the expense of delivery capacity. Assured funding will do more for maintaining program memory and specialties than just a build-up in one sector, and will also ensure the build-up remains built over time.

P12	Question #10 The inventory to date has not been capitalizing on new technology appropriately. The implementation of better tools for data capture are blocked by current government standards which do not include digital aerial photography as a legitimate data source. Similarly the lack of standards for lidar also impede the implementation of approaches which capitalize on advances in technology. A pilot project to demonstrate the value of alternate approaches may provide an opportunity to better quantify the value of approaches which do capitalize on new technology as opposed to doing things the way they've always been done with a heavy reliance on conventional aerial (film based) photography.
P13	9. Delivery Model, Roles and Coordination The Review will have to examine and investigate Staff Roles at the District and Regional Levels. The issue is delivery of services internal to the District and Regional staff in other programs. 14. Other points to make Forest Health /Climate Change Issues The winter of 2005/06 was one of the warmest on record. MPB and Dothestroma are possible Indicators of climate changing. Development of a Monitoring Strategy is supported. The effects of climate change may have greater effects in the north, as it is forecasted to warm higher in the northern latitude along with wetter summers in the central interior. Performance Monitoring of Young stands (which are the mid and long term timber supply) is an issue.
P14	5.1 While I do think the review is appropriate, I find a lot of preconceived notions within the text of this document about what's going on in the FIA / LBIR system that I find not true. I think some FAIB personnel need to be more involved with outer processes to educate themselves how they truly work so they are "not throwing the baby out with the bath water". To finish the statement *"This review would be worthwhile if … FAIB staff truly go into the review with open eyes."* 5.2 Top Priorities ▪ Ecosystem – based management ▪ Habitat Supply Analysis ▪ Harvest Planning (still is important) & 2nd Growth Analysis & Harvesting ▪ Growth & Yield initiatives ▪ TSR 5.3 I see in the next 5 years finally finishing off the VRI and TEM inventories on the whole coast and then moving to addressing known weakness in the final product.

5.4

Priority Inventory Services & Products

- Up-to-date inventory information (all updates complete to present)
- New inventories where the are really needed (e.g. Mid Coast - should work with the cooperation of local LBIR group) – for instance I recently worked with Mid-Coast data where some of the Reference Years (year of data collection) were in the 1950's)
- New Provincial / Regional Growth & Yield Systems

5.5

There is a gap in the Growth & Yield processes that should be filled regionally and/or provincially.

5.6

As current legislation stands TFLs should be the responsibility of the TFL holder. If the holder's real money has paid for the inventory then it belongs to the TFL holder and negotiations should commence with them if the government wants the data. On the other hand if 100% FIA funding went into the TFL inventory then it is public domain data.

Parks and private land, while important to have – especially at a landscape unit level – should be either done to a lighter standard or put off until areas with more active planning processes are completed.

5.7

While you may never be able to approach the accuracy of an operational cruise, the program should be modified to accomplish something other than a 'strategic level' accuracy level, at least for the long run. The end of the VRI inventory program after the adjustment is done should not be the end of the inventory work. The inventory should be revisited and analyzed for areas of improvement (e.g. 2nd growth, deciduous, etc.)

5.8

Access has greatly improved with the advent of the LRDW. While some tweaks could be done to the system this is generally a success story.

5.9

While there can be some small modifications to participation in the LBIR processes, I think it is important to have local level buy-in for feelings of ownership and generation of support. Again "don't throw the baby out with the bath water".

5.10

I believe the key to incremental improvements is not so much the reliance on technology to improve information. A better solution is to have a long term program that doesn't end at the calculation of the VRI adjustment. Immediately upon completion of the VRI a review should be implemented that identifies weaknesses and gaps in components. A long term plan should then be devised to address those weaknesses and gaps. The key at that point is to plan small, annual, "incremental" projects that don't require major annual budgets.

	5.11 My impression is that the forest community outside FAIB does understand the value of forest inventory information. This is reflected in the support for VRI / TEM programs in the DFAM / LBIR groups. 5.12 Capacity, succession, and training can only succeed if there is a long term financial commitment for annual VRI work. This was identified as a problem with VRI Phase 2 training. Training was offered up in the nineties and many did take the courses. At the time, though, there wasn't a lot of Phase 2 work so many felt they wasted time and money on the training effort. 5.13 Most of my comments up to this point address the government issues stated here. The main point in all this is that I believe FAIB has a misconception about what types of decisions are being made and the type of participation in the local DFAM / LBIR groups. In all the meetings I've attended MoFR district and/or FAIB (usually from the analysis side) staff are there and they help with the decisions (many of the meetings are held at the district offices). It is incorrect to suggest "MoFR has little input into investment priorities". If VRI FAIB personnel want to attend these meetings they are welcome to come. 5.14 Most of my points have been made throughout this document.
P15	• The review will be worthwhile if, a clear plan of action is developed that is supported by the major stakeholders and the plan is acted upon within an acceptable time frame. We have done these reviews before and very little of the recommendations, actual come to fruition. • Top 3 needs of inventory that should be met; AAC determination, Accurate Species/Age/Height information on a drainage basis, Accurate volume on stands that are greater than 40 years old. • In 5 years and beyond we must be ready to accurately reflect the impact of insect damage (MPB in particular) within the inventory. Much of the Pl dominant stands will be harvested in the next 5 years, but mixed wood stands with a minor component of Pl will not be. . . what will this stand look like in 5 years? We can not rely on a full re-inventory (cost) to accomplish this. • A major gap in the inventory is the level of confidence in using the inventory on sub-strategic level analysis. Drainage or stand based analysis is probably the largest use of the inventory yet the number one priority is TSA level "statistical validity" . . . this does not equate to accuracy . . . • TFLs, Parks and Private land forest inventories should be part of the overall mosaic, but emphasis should not be placed on these areas. What ever data is readily available for TFLs could be adopted. Photo interpreted information on Parks should be all that is needed. Due to the nature of private land it may not be cost beneficial to spend dollars inventorying something that could change tomorrow and would then not be reflected correctly in the inventory. Simple satellite algorithms may be useful in creating and or updating private land and park inventories.

	• Although this inventory should not try and take the place of specific stand level assessments, it should also, not rely on these assessments to pretend they augment its data. These stand level assessments are captured at a time in the business process when the information is not relevant for long periods of time. More emphasis needs to be put on photo interpretation and stratum size when initial establishment of the inventory polygons is happening. There needs to be more emphasis put on key stand level data – Species, age and height, to allow users to feel more comfortable using the data for sub-landscape analysis. • There still seems to be some unnecessary barriers when trying to acquire forest inventory information. • At this stage the roles and responsibilities of everyone involved in inventory are not clearly understood. This IPR needs to address that. • We haven't done a good job in the past dealing with known issues in the inventory. When we know there is an issue somewhere we tend to try and fix more than that (sometimes doing a complete new inventory). This approach waters down the benefit. Satellite imagery and image analysis tools could go a long way in addressing some suspect information in many TSA's. • Appendix 1: o It seems there are many ideas discussed in this appendix that tend to make many assumptions based on how things used to be. The inventory capacity section makes a bunch of assumptions that are not necessarily government's role moving forward. For example items listed as (2)-(5) do not have to be government's role. o Using consultants may not increase cost in inventory creation if items 2-5 above, were streamlined o The business climate today is vastly different than 15 years ago with the Forest Resources Commission. Business has clearly shown what is important to them when collecting new inventory information. The VRI standard needs to be curtailed to what has proven to be a need and one that is sustainable going forward.
P16	1. This review would be worthwhile if it provides some clarity on what questions we need to answer with this inventory, results in the development of a plan to acquire that inventory and resources to make it happen. 2. The priority is an inventory that provides a good description of a disturbed stand in the interior and a partially harvested stand on the coast. 3-4. We need an inventory that has accuracy below the MU level as we will be using it that way regardless of whether that is appropriate or not. 5. The land holder should be responsible for the inventory and gaps should be addresses strategically at the provincial level. 6. The inventory should cover the entire province with no exceptions, and use best available information. 7. I think the inventory needs to be accurate at a subunit level, maybe landscape level. That said, I think the current phase 2 inventory adjustments are of very limited utility and the dollars spent might better go into a better phase 1. 8. Coordination, there is none as it is currently totally haphazard. The landholder (Gov.) should manage and conduct inventories that reflect provincial scale priorities.

	11. You cannot manage and get the most value out of something you know nothing about, so an inventory is critical. The value of this inventory is very limited if you believe it is only useful at the Management Unit level. 14. Why has the utility of the VRI been so limited that the MOF and Industry have not felt the need to upgrade from FCI to VRI? Is there no benefit to the change? Ask Staff what they think.
P18	4: User friendly access to data is important. 6: A provincially seamless inventory may be too large of a step. Depending on the district or region, many land use planning issues are on a landscape unit (LU) or district/TSA basis and depending on the licence holders they may have all the necessary data (i.e. many TFLs are made up of a number of whole LUs). Perhaps, look to the districts and see where seamless inventories currently exist or could exist with minimal effort and start prioritizing at a smaller unit level. The province is too big to expect that data will ever be at one standard or one level of currency but district-level info might be within a tolerable level. 6: Getting basic inventory on parks would beneficial from a wildlife and biodiversity perspective. Some of the new parks have this information but there is not good coordination with Parks Branch to ensure that it is the current info or if they have better data. 7: It is recognized that VRI is a management unit inventory, but we do push its use to other purposes because we have not alternatives. During the review, it would be interesting to identify how it could be improved to be used more accurately at a landscape unit level. The answer is simple (I think), more plots but can they be done over a number of years? Can local information be incorporated back in (as was originally planned) to improve the inventory? If we could create a base, that is continually improved as opposed to replaced (every 20-40 years), we would truly be improving the inventory program. 8: As a licensee access to data is difficult and bureaucratic. The data sharing agreements have been so difficult that often they are not attempted and different routes for the data are followed (i.e. buying it) but this does not achieve the exchange of information back into the system. In the current world of electronic submission from licencees through FTA, ABR & RESULTS it would seem that information is going in so that simple access to resulting data should be made available. However, once access is arranged the LRDW actually works quite efficiently. 9: What has happened in the past 5 years with inventory is unacceptable, inventory has been pushed around between both government and industry. Industry has done some work through FIA funding but ownership of the data was always muddled. It needs to be decided who owns the data and then move on. If it is industry (which I do not believe is a logical choice) then government needs to not set rules regarding it. If government owns it, then they must make it the priority that it is and perhaps through partnerships work on improving it or just do it acknowledging that the province is the long-term beneficiary of the data.

P19

Critical Questions

1. Inventory Program Review

Getting input from many stakeholders is a great idea at an early stage of the process. In the end, the details of the vegetation inventory and G&Y will have to be done by a very select group of highly experienced inventory persons that are very familiar with what has been done historically in the province. They will also have to wade through all the dialogue and draft a convincing inventory plan that will satisfy the real forestry needs in BC.

2. Today's Top Business Needs

Need to define the provincial-wide vegetation inventory program that will be in place for the next 15+ years and then get a long-term commitment from the government to fund that program.

No. 1 need is to map the productive forest land in the province and to describe it accurately to facilitate sustainable timber harvesting and adequate reforestation/rehabilitation.

No. 2 need is to have a vegetation inventory that will provide sufficient information about the BC's forest resource to facilitate all major forest activities including protection, silviculture, engineering, recreation, planning, modeling……

No. 3 need is to provide spatially accurate vegetated and non-vegetated land cover information that will support the planning of other resource values including wildlife, hydrology, fisheries, recreation, urban/wildland interface, tourism, wetlands, other industries…….

All forest activities should be based on good information about the forest….it all starts with inventory. In the late 50's through the mid 70's, almost all new BCFS forestry recruits from universities started out in the Inventory Branch and they all did inventory fieldwork. Why is it today we seem to think so differently? During the past 35 years, I have seen the Inventory Branch go from a force of dedicated and very knowledgeable inventory experts (many of them European), all with years of field experience to a small group of individuals that hardly ever see the bush and many counting the days until they retire. And where is the leadership? At one time, most Regional Managers, Branch Directors and Forest Executives had been through the Inventory Branch early in their career thereby having great appreciation for good forest information.

3. Future Business Needs

Do we need quicker and more accurate information, semi-automated classification, a better understanding of what technology such as remotely sensed and analyzed data can do for us, super-models……or do we need to start by rebuilding the inventory expertise in the province? **Me thinks the latter.**

4. Priority Inventory Services & Products

a) Finish the inventory coverage of the province to a consistent standard.

b) Revitalize effective site productivity, G&Y, NVAF and ecological mapping programs. These programs must be closely linked with the basic provincial inventory database.

c) Decide how the inventory is to be kept current or updated.

5. Different Inventories

A provincial-wide inventory cannot and will not provide all of the information for all circumstances. Being stewards of the crown forest land base, the government must decide what level of information is needed (by government and by industry) to adequately manage the forest resource. Needs beyond this will have to be designed and funded by the other interest groups.

6. TFL, Park & Private Land

TFL – Should meet or exceed VRI standard on crown land. If more detailed attribute information is provided for a TFL, it should be designed in a manner that can be fed into the provincial VRI database.

Private Land - Outside of major cities, inventory of the private land in BC is not a big issue. It should be done at the same time as the TSA inventory but perhaps have broader typing (larger polygons) and have no fieldwork (the classifiers can photo interpret private land using field information from adjacent crown land).

Parks – Small Parks should be done at the same time as the surrounding TSA. Again, with no fieldwork (unless BC Parks pays for it) and perhaps broader polygon delineation. Each larger provincial park should be done as a separate inventory to the VRI standard of photo interpretation but with BC Parks funding.

7. Accuracy

I feel current TRIM **mapping accuracy** is more than sufficient. SPOT 5 or better scale photo/imagery is good for updating cutblocks, fire boundaries and roads. Red attack needs at least 1:25,000 scale color or CIR photo to map.

Attribute levels of VRI Phase 1 allow for as accurate as ever needed. Species to nearest percent, age to nearest year, height to nearest 0.1 meter, crown closure to nearest %, density to nearest stem, basal area to nearest sq m. This accuracy can only be approached by very experienced interpreters, lots of fieldwork and very good photo. This in turn will cost more $/ha.

Site productivity, G&Y, NVAF – answers are harder and more expensive.

8. Information Access

Rumor has it by the time the information is accessible from MoFR, it is out of date. FAIB has to become more proactive in getting the message out about when the information is available, how it can be accessed and then how to use it (or at least what the VRI program is). Since 1995, very little information has ever come out of the Branch pertaining to the VRI program.

9. Delivery Model, Roles, Coordination

Delivery model will have to be addressed after the program design is finalized. Ultimately the government is responsible for vegetation inventory on crown land. Therefore, MoFR must define the standards and specifications of all aspects of vegetation inventory.

Phase 1 and Phase 2 of VRI (or equivalent) may be managed by industry but needs to be co-administered with a MoFR regional inventory expert. Other highly specialized inventory programs (site index/productivity, G&Y, NVAF) should be administered by FAIB in Victoria.

10. Improvements, Technology, Innovation

Yes, there is lots of room for new technology and innovation and yes, we can easily have the expertise if all those who benefit from the forest resource contribute accordingly. The government is the recipient of harvesting revenues and forest companies are in the business of making money out of trees. Forestry is big business and vegetation inventory is a necessary cost of doing business.

11. Value of Inventory

Wow……. BC is blessed with the greatest forest resource in the world. The government must fund the inventory programs required to properly manage this resource. It's all about stewardship and accountability

12. Capacity, Succession, Training

Dwindled but still alive and well in the consultant world. Government needs to ramp up staff and expertise. With a guarantee of a 10 year funded program, consultants will be there to get the work done. VRI training programs must be continued with appropriate modifications.

	13. Appendix 1
	Generally, agree with the issues and their comments. **Final Comments** I commend the Chief Forester and the Assistant Deputy Minister in sponsoring this Dialogue. BC has always been a world leader in forest inventory but the current government has put inventory on the back burner. The current VRI program is actually a very good one. It was designed over several years by scores of forest and other resource specialists. Yes, it needs some improvements and injection of innovation, but in order to start the process, it needs more leadership, expertise and continuous financial support at the Inventory Branch level. Since the Crown owns most of the forest land in the province, MoFR needs to determine the inventory program and funding vehicle. At the same time, the forest companies need to have input as is happening in this dialogue.
P20	Review worthwhile if more decision makers realize the benefits of holistic and integrated approach to (terrestrial) physical and biological inventories **Priority business needs:** Total cost accounting of relative benefits of fibre harvest vs. provision of ecosystem services in the global context. Impact of harvesting scenarios and other forest management decisions on non-target resources and processes Ecosystem resiliency – where are the sustainably harvestable surpluses? Derived information from VRI – age-class themes, productivity themes by species, species distribution models (maps) structural classifications … **Future business needs:** Rationalization of ecosystem and vegetation classifications at a variety of scales to better deal with anticipated redistribution of biota caused in part by climate change 6. there must be a way to derive useful information from TFLs, PPA and private, generalized to the point where it doesn't unduly impact proprietary information critical to maintaining fair competition in the Forest Industry 10. Remote sensing technology is maturing (including satellite and airborne sensors) and should figure prominently as a third phase (or new first phase) approach to vegetation inventory

P21	Question 2: Our critical planning and decision support needs revolve around MPB-killed stands, and where/how to allocate them for harvest opportunities and retention (deferred harvest, conservation). Volume is being allocated based on the old inventory, yet field checks are revealing that the volume may not be there for the licenses. We need relatively up-to-date information on what is there, what condition it is in, and how it is being depleted. Minimizing the timber supply falldown that will come in 5-10 years absolutely requires good information on the condition and location of our non-pine stands, immature natural stands and plantations. This information needs to be gathered and available to government and forest managers ASAP. Question 3: Growth and yield programs will play a big role in assessing the timber supply of the future, particularly with the uncertainty of future forest health concerns, climate change, etc. Consideration needs to be given to how to better integrate G&Y into VRI, to create efficiencies. There is much opportunity with MPB/wildfires and subsequent harvesting to rebuild G&Y into managed landscapes. Question 6: All Crown land should be included in a single provincial vegetation inventory. Efficiencies and economies of scale should be taken advantage of at any opportunity where public funding is involved. Data acquisition, standards and level of standard application should be applied consistently in order to save time and money later, to avoid data incompatibilities that could happen if parks and TFLs are dealt with separately.
P23	3) Future business needs; MPB and under story stocking. Long term loss from lack of knowledge of the current MPB out break. 4) Most limiting factors: no-one is accountable to have an inventory; Nor do we have a description of what an inventory is. Or what the current uses are. The continued lack of budget. 6) Yes the TFLs should be held accountable for the same standards or they may exceed it as long as the data that we receive can be entered into our current computer compilation program. 10) Pease use new technology. 12) Very Very Funny!
P24	1. In the 90's we missed the significance of TEM & PEM to our future needs. I would add TEM/PEM to the IPR. Ecosystem mapping is absolutely critical to future management actions. 3. We need to develop the responsive to deal with emergent issue like the MPB. In this context, a sampling solution to capture existing state and monitor changes on year to year bases is critical. The issue is the 'system' response enough to permit this to happen. Recent experience suggests that it is not. 5. Drive these assessments based upon the local needs of the TSA/TFL not on a common provincial model. Why would you invest money in the Cassiar TSA?

	7. Given the movement of cruising standards towards VRI standards , CGNF should we not move our thinking to capturing of these data referenced by ecosystems to develop future models of inventories based upon actual cruise information,? 10. Incremental improvements will not happen under the current paradigm of controlling the process of inventory rather than the outcomes. If you continue to duck walk partners through endless months of reviews and consultation, no one will be interested.
P26	Critical Issues 5.1: I think this review is critical. Are you including TEM, PEM, Bio-Terrain, etc inventories that licensees are building new VRI Inventories on and whether these are beneficial and possible cost efficient?
P30	1. It is definitely appropriate and will be useful. 8... It is very difficult to access data. 9. A partnership of industry and gov't staff. Gov't staff should set priorities and assist in management of projects.
P31	Where are the persons trained going to find work to apply their new skills? Is there work out there? and money to enable it to be completed? A strategy is a great idea; and fundamental to meet your challenge, but funds will be needed to implement it. If there are no funds the strategy and any effort to train persons will be wasted as they people go on to find different jobs. The feedback form is very limiting. There was no discussion on Barriers to moving forward, Substitutes, Strengths, Opportunities or Weakness that should be considered. This might be a more effective way of opening up the discussion. Eg. Focus on your strengths, reduce your weakness. Perhaps this is the next step in the Challenge process Access to data is difficult- unless someone comes to us with a project of greater than $2000 we aren't interested in doing the works because of the effort it takes to access the data. The data is openly accessible to view on the internet, can it not be accessible to use and manipulate as well, or is there a conspiracy theory/security concern?
P32	1. Inventory program review is timely. Focus on timber, but include non-timber resources where they are of significant value. 2. The top planning and decision-support needs are... a. timber types and volumes and areas. b. PEM/TEM c. areas and volumes impacted by oil and gas activities. 3. There is great uncertainty of inventories now and poor communication between resource users since they currently have their own data; this needs to be standardized, rationalized, and shared between resource users and stakeholders.

	5. One gap in current inventory is the area impacted by oil and gas. 6. Call for consistent standards on all lands. 10. Oil and gas industry and ministries may contribute towards inventory costs if it can be shown that updated information will facilitate resource development and reduce risks.
P33	It is always worth reviewing progress here. I cannot find a good description of the actual steps involved in the VRI through all phases including change over time on the web site so it is hard to examine all the critical questions.
P35	1: There are links to other programs that have not been addressed, including the overlap of standards, training capacity, and certification of MOFR CGNF appraisal cruising and the evolving role of the (ASTT) Forest Measurements Registration Board. 9: Conducting inventories should remain where capacity exists: consultants. The MOFR should have a bigger hand in managing the inventory (e.g. setting priorities, etc.), including contract management standards (e.g. open bidding) to ensure an appropriately sized and competitive capacity is maintained in the province. 12: Depending on outcome of review, phase 1 training, and phase 2 ecology sampling capacity is lacking immediately. 13 (Appendix 1 Comments): Missing linkage to MOFR coastal appraisal cruising (CGNF standards, NVAF replacing DWB factors). Inventory capacity and succession challenges are bigger than competing with other jurisdictions or planning for retirements. The looming demographic problem of retirements is intersecting with a downward trend of forestry graduates. The Foresters Act now includes RFTs, and that has increased demand for educated and experienced technologists throughout the industry. VRI photo interpretation and sampling specialists are usually the most experienced of the technical community, and these people will be in high demand by many employers outside of inventory. Consistent, long-term funding of VRI is the only way to maintain capacity in government, industry, and consultants. Corporate memory and specialized knowledge aren't the same thing, nor are they exclusive to companies or government. Program memory, including specialized knowledge and limited corporate memory, exists in individuals in all three sectors of forestry. Down-sizing in one sector (e.g. gov't) usually leads to a build-up of capacity in another (e.g. consulting), and vice-versa. Government inventory is definitely understaffed, but care should be taken that a build-up in capacity for support and monitoring doesn't come at the expense of delivery capacity. Assured funding will do more for maintaining program memory and specialties than just a build-up in one sector, and will also ensure the build-up remains built over time.

P36	3. Climate Change, Monitoring GD, Ecosystem services (carbon credits, genetic diversity; tree improvement); Access & Benefits (GR) 5. linkages to tree improvement, genetic gains, genetic diversity, in-situ gene conservation
P37	The answers to many of the questions asked will be as diverse as the number of stakeholders sampled. We can certainly try to focus on future business needs, products, services, etc, but perhaps the focus should be on what are essential or basic information needs that will be required to meet legal provincial obligations (BC has signed on to many accords as well as having a stewardship responsibility) and then expand outwards with different options and scenario's based on user feedback more specific than I am able to provide ☺.
P38	1. This review will be worthwhile if it leads to action and improvements in the inventory program. 2. How will mixed stands in which the pine has been killed by MPB (but not salvaged) develop? (G&Y component of inventory). How will the advance regen and new regen develop in stands of dead MPB which are not salvaged? 3. I think that we might be looking at getting different products from the forest (both timber related and non timber) (different meaning other products besides sawlogs and pulp due to development in other countries and changes in the values we expect from our forests). Keeping the inventory process flexible enough to consider these developments is key. 4. N/A 5. I think this is what I was thinking of in answering question 3 above. There could be lots of other inventories (mushrooms for example) that would rely on the broad forest inventory to identify key areas for closer/more focused inventories. i.e., pine mushrooms tend to grow in a forest with these kinds of attributes. So someone could look on the forest inventory for stands that meet those criteria and then go and get more detailed info from them. (narrowing down the focus) 6. Yes, TFLs, parks and private lands should be included. (Private land may not be quite as critical but definitely TFLs and certainly parks. Yes, they should use the same standards as those used in the non TFL or Park area. If they would like more detail for different purposes then they can collect that info but there should be some basic info that corresponds to what is collected outside of these areas. 7. Not sure. Also not sure about the metadata requirements. 8. Not dealing with accessing inventory info on a daily basis so I can't really answer this question. How to access info might make a good newsletter article for FORREX's LINK. 9. Government should have the bulk of the responsibility since they are the stewards of the land. I think that industry should lend a hand though – maybe a 75 G/25 I split. I agree with the comment by inventory staff that the district folks should be involved. That would help them to be more familiar with the land base and would be good for the inventory since they would be more familiar with the land base. 10. Not sure 11. I don't think so. No we're not. Very strong. 12. Described well by inventory staff in the appendix

	13. Agree with them all 14. No
P40	6. A seamless BC-wide product is an essential requirement for many users. 11. No the value is not always recognized; more wide spread use could be encouraged with simpler value-added products.
P41	1. I think the IPR will be worthwhile if it actually brings the inventory program back to the government and is funded to a level that will achieve a provincial coverage updated over time. 2. - Obvious need is to address the change in the inventory due to dead trees. It will be important to conduct new inventories maybe 5 or 10 years after the bugs have wiped out an area in order to assess the ingrowth. - Complete coverage, including parks and TFLs - Upgrade older inventories that have fallen off the table due to the change in delivery mechanisms these past few years. 5. We need to be able to layer data for analysis purposes. We shouldn't try and cram data for every possible use into the VRI. We have collected linework for large fires for example, but they do not need to be cut into the VRI as they weren't done to VRI standards. But they are a very useful layer for analysis purposes at the TSA level. There was also a push originally to take all the RESULTS data and cut every internal polygon into the VRI. The RESULTS data is far too detailed for VRI needs. The VRI needs to avoid being a data dump inventory. 6. Yes, but they don't have to be to the same standard. Parks could be a modified VRI (tree emphasis). But there needs to be a provincial VRI fabric for reporting purposes. 7. The inventory needs to be statistically defensible at the TSA or strata level, not at the polygon level. We would never achieve that level of accuracy within reasonable costs. 8. I am familiar and used to accessing data from the LRDW. However it can be a learning curve for some folks. Also the upcoming change in the VRI data model is going to need to be widely communicated. 9. It isn't working!!!! There are major information gaps being created because the inventory program is no longer being driven provincially. Areas have been reinventoried that didn't need it, and others are being left out. This needs to change. Government, with all its warts, at least has no hidden agenda when it comes to where inventories happen. 10. We should be a little careful here. New technologies can be pushed too fast by consultants without a complete look at the improvements the technology may or may not bring as well as the cost. The cost seems to be left out of the equation quite often. I'm all for investigating new technologies, but we have to keep in mind fiscal realities as well as the purpose of the VRI. Perhaps something like lidar could be useful for sampling situations, but I think proposals to map entire TSAs using it to collect new polygon attributes isn't a cost effective use of the technology.

	We certainly need to take advantage of large format digital cameras. It looks like there could be some major time savings achieved when it comes to data delivery. We are still waiting for some of the traditional orthophotography to be delivered from our 2005 flying season. This turn around time is too long. 12. The capacity, training and succession issues are huge. Over the past years the program has been crushed, both in government and in the private sector. A lot of our inventory companies went to Ontario so we have very little capacity right now. The government inventory staff was gutted across the province leaving very little capacity. Some of those left will be retiring in the next few years, creating an even larger hole. 14. The VRI program could use re-structuring. The silos need to be broken down. There needs to be much closer connect between the present data loading group and the update group in Kamloops for example. VRI is ONE program with many working parts. The parts need to know and have a basic understanding of the other parts to work effectively. At the moment there isn't enough synergy between the three silos. They are being treated as three separate programs almost.
P42	The review will be worthwhile if … please see comments at the outset. Today's priorities – Services and Products: 1. Integrating tree-level (stand and stock table) information into the inventory. 2. Continuing to establish long-term growth and yield monitoring plots that are generally representative of the populations of managed plus natural stands; moving from the traditional growth and yield program toward this kind of forest monitoring program. 3. Integrating the use of plots in 2 into a formal system of updates. 4. Identifying the core components of the inventory that are needed to be maintained and updated on a routine basis. 5. Develop a more stable system of inventory management that includes a strong education component as it relates to the use of inventories and their application to strategic and operational issues. Current Business Needs: 1. Determining which trees and which stands to cut, when, and which to leave behind in the face of natural disturbances, the need for water and habitat protection, the need to provide employment and benefits in an industry that is faced with significant global competition, and the need to provide for the greater well-being of our communities. Different Inventories for Different Circumstances 1. We need to understand what is core to a Provincial inventory and what additional kinds of information are needed to deal with more local issues. Future business needs: 1. An increasing demand to be held accountable for what we do in terms of forest and community level impacts, which requires that both operational and strategic planning and management be accommodated within the inventory management framework. TFLs, Parks, Private Land

1. Yes the information should be included in the Provincial inventory. Yes there should be basic Provincial standards for data collection.

Accuracy

1. … But operational cruise data should and could be used to better understand the inventory and its estimates. This includes reconciling inventory, cruise and scale-based volumes. If we do not start coming to an understanding of the inventory at an operational scale, then we will continue to proliferate policies and practices that are out of step with operational realities. If we find that certain strata have for example a 30% fall down in certain kinds of volume, then we may be setting ourselves up for a situation where we think there is a good supply of timber available for harvesting, but we can't find it. Such issues impact on our ability to manage all resources, not just timber, particularly since we are reluctant to shut mills and communities down. Our inability to understand the inventory at this level of detail is really impeding us in terms of responding to the bark beetle. Instead we keep trying to address the issue by driving around in pick ups and flying around in helicopters, but this is still not enough to gain a real appreciation for the kinds or varieties of stands we have available to manage, because neither of these modes of transportation allow us to properly reconcile tree, stand and landscape level details from the perspective of the inventory as a whole.

Delivery Model

1. This may be the # 1 issue. We need to collectively understand the importance of the inventory and thereby be committed to maintaining and utilizing it across all sectors. If there is not a collective will, understanding and participation in developing, managing and utilizing inventory information, then we will continue to rely on erratic funding and we will continue to produce piece-meal results.

Incremental Improvements, Technology, Innovation

1. I have been working within the TOLKO (formerly Lignum) IFPA since 1998 developing tools for enhancing inventories such that the latter may be used for both operational and strategic purposes. These tools include:
    a) Stand structure classification
    b) The development of an open source stand structure compiler enabling people to compile their own plot data in terms of 1 of 2 stand structure classifications – the TOLKO system which is independent of species and the CANFOR system that is dependent on species. Both classifications distinguish stand according to differences in the numbers of trees by diameter class.
    c) Methods for extrapolating stand structures from known points in the inventory to unknown points and subsequent methods for deriving stand and stock tables for each polygon (TOLKO Williams Lake).
    d) Methods for inferring inventory polygon stand structures and associated stand and stock table information using cruise plots data (CANFOR Prince George).
    e) Using the information in C (200000 + polygons in the Cariboo) developed a bark beetle simulation model that bridges operational and strategic kinds of decisions by simulating the impacts of beetles on tree, stand and landscape levels for a period extending to 2020 (or beyond). While the model is not supported with a growth model, it does simulate the impact of bark beetles at the tree-level of detail by accounting for expected log degrade and losses in recoverable volume with time from individual tree

	mortality. In combination with stand structure classification, the resultant data set could be used to develop a harvest priority rating system, thereby identifying the kinds of stands that should be of highest priority for harvesting so as to recover as much value as possible while at the same time maximizing the potentially viable wood supply for the longer term (conservation of resources). f) The potential to incorporate growth and yield forecasts into the model, such that the trajectory of stand development is more realistically modeled as being dependent on stand structure characteristic details; such a model could be used to more effectively address wood and habitat supply issues in conjunction with the development of silviculture and harvesting prescriptions. g) Consideration for inventory updates through the growth and yield projection of the underlying plot information, along with the ability to check these projections relative to plot remeasurements, thereby leading toward an integrated inventory and management planning system. Value of Information: 1. I do not think that the value of inventory information is understood, let alone appreciated for reasons that I have already highlighted.
P43	1. ….links a sampling system that can move from strategic inventory -> stand level with minimal RISK and acceptance by industry, government practitioners 2. account for accurate height and age; being able to move the inventory for use at both the MU level and landscape level 5. Wildlife inventory 6. IF the province wants to include private land in the VRI, then the province needs pay for it 7. Big run here since the program is not expected to replace stand level assessments from Victoria's view point however when it gets down to the Districts, the VRI is being used for stand level monitoring for landscape unit planning accounts 9. Government responsible to deliver but unable to provide incentives to attract further buy in by industry 11. Strong value as it is tied to increase/decrease in AAC. Weak value to SFM as there is little incentive to get non timber values monitored. Who pays for non Timber values? Similar to most forestry related professional attracted to the forest inventory& forest cruising is not as attractive to entry level labour force compared to computer video games. If the crown desires to create new opportunities to continue to deliver forest inventory to meet its SFM and be adopted and accepted by both gov't, industry , incentives must be offered to industry to set a business plan by the forest sector to carry on doing what the MOF is not able to do. If industry comes on board, they will hire consultants as well to get the job done. The FIA model works, The IFPA model works, providing incentives to leverage additional dollars to do the task .

	I t is important for the province to set the objective and stream line the content of what is needed for VRI.
P44	Q.5: The present inability to create seamless inventories must be addressed. As 95% of the land base is public land, all funding being devoted to this work is also public, and gov't is responsible for conducting all large-scale planning, it is logical that data is available to a common standard across all ownerships/tenures. This was a key recommendation of both the Forest Resources Commission(1991) and the Timber Inventory Task Force (1992), and one that was never implemented over the intervening 15 years.
P45	Missing is the Question regarding Forest Health Inventory Challenges. It is expected that insect and disease problems will increase as the climate warms. The Inventory program has an important monitoring role to measure and record changes to the Forests.
P46	5.1 - yes the review is worthwhile and it will be worthwhile if and when an implementation plan is developed and put into action. We also need to see the forest centric mindset fade away. 5.2 – new management needs: Inventory program needs to improve its ability to address MPB, Climate Change, Fire, and EBM. Answer – more ecologically based approach. 5.3 – EBM – need for an ecosystem base map with monitoring and permanent sample plots as a means of tracking and managing the effects of NDTs, MPB and climate change. There is also a need to easily grow ecosystem maps (model structural stage for habitat) which means the forest inventory and ecosystems need to use the same lines. We will need to simplify the product as there will be a greater demand for our products from a much more diverse user group. 5.5 – too much focus on the forest – there are many other resource values that are not currently being adequately inventoried. In order to effectively manage the land base it should be managed in a more ecological manner. Related to this is the issue of private vs public lands and the gaps which are currently present in the inventory. An effective inventory should not be restricted by administrative boundaries. 5.6 – yes see above. 5.9 – in order to better address the needs of government, could the funding model be shifted slightly to allow industry to focus project dollars on mtg only their needs. Government would then require a greater portion of the funding in order to top up project dollars, as a means of meeting additional government needs? Or simply give government more control over how and where money is spent on individual projects? 5.10 – innovation, with the advancement of modeling techniques, can phase 1 be modeled (similar to PEM)? This could then be supported through phase 2 sampling and continued monitoring. And yes the collective resources are available to support technological advancements. 5.11 – No the inventory is not being used to its full capacity…users do not understand or recognize the full extent to which the data can be used. The business case is definitely there (especially if the program makes a shift to a more ecological base) and simply

	needs a more focused, coordinated effort put forth to get the message out to users. 5.12 – in house capacity to do the work required is decreasing, external capacity is decreasing, there is a huge risk of loss of local knowledge and expertise – need for a succession plan?
P47[8]	1) The IPR will be worthwhile if it can separate the "must knows" from the "nice to knows". Presumably you will then have better chances with Treasury Board. 2 & 3) The inventory needs to be able to describe a "disturbed stand" either by bugs or partial cutting—both the residual structure and the regeneration. 4) summarize the inventory and explain how it has evolved over time and what are its strengths and weaknesses for an MU. 5 & 6) strive to achieve a smaller core set of attributes across the entire landbase—extent, age and health (within parks etc) and tree dimensions on the THLB. Changing circumstances could be tracked by a comprehensive monitoring program. 7) the inventory needs to be as accurate as the budget allows across all age classes. This may be better achieved by more ground calls across all age classes rather than a single ratio adjustment by leading species. 8) Yep 9) Industry should be able to lobby government for what gets reinventoried but I think the responsibility for doing so best resides with government. We do not need any more Lignums. 10) You could do worse than experimenting with "LIDAR". 11) You cannot claim to manage what you do not know. 12) The succession challenges within inventory are actually an opportunity to pump new blood into the program. Embrace that opportunity and empower your staff, give them the training they need, encourage them to think, let them become the recognized experts. While data collection would continued to be done be contractors, foster an environment where analysis is done in house. 13) Involvement of district folk in the delivery of the inventory would be a good thing. Presumably better knowledge of the inventory would help them better regulate the harvesting of the resource. 14) Unless the volumes are guaranteed to go up industry would likely have little interest. The loss of cultural handles in full blown VRI inventories makes VRI more difficult to use.

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[8] Delayed Response—received after first compilation

Input Request 5: Next Steps

INPUT REQUEST 5: Please provide your feedback on the Next Steps and use this space to make additional comments or raise other questions.

- Do you have any comments regarding the Next Steps?
- What other perspectives would you like to add to this Dialogue?

P1	Good start. Need to reestablish sound inventory component within the organization. Need to update to current VRI standards all districts, especially those with accelerated harvest due to beetle. G&Y info and our permanent sample plots critical for management assumptions. Need to implement reestablishment and remeasure program and follow through with it. Need to examine the climate change issue and factor in BEC and species shifts and potentials for increased forest health issues. Need consistency and accuracy in our info. Need to ensure QA in place and standardize to ensure integrity of data. This will give confidence in management decisions.
P3	We have been working in forest inventory for 12 years and 15 of our 70 full-time staff work in this particular area. Currently we are working for several government agencies and different ministries. We feel we could provide better insight in a less structured forum, where we are provided more background information. As a forest professional the future in inventory does not look positive, and there appears to be an exit out of this sector. The companies that used to be involved have mostly left, downsized or are working out of province or country. Inventory doesn't seem to be a priority for funding, hence the variability in the funding. There needs to be better co-ordination with the oil and gas sector. A few different groups in government are doing this, but the activity is slow as the dollars don't seem to be there. There are several 'empires' within the provincial government that control the inventory. This is typical of any large bureaucracy. The reduction in the size of government has been good because the empires have started to shrink and have been forced to work together. I am not sure if new funds invested in the government work force would help the situation, or if those funds should be awarded to licensees or private companies on 3 or 5 year contracts. The longer-term contracts create some stability and enable new skills sets to be developed – outside of one of the government empires. We have developed skills sets in inventory that we provide to several different government agencies and Ministries, but the funding is variable and it is difficult to keep the skilled staff that we develop as we jump from one agency program to another to try find some stability. If a strategy can show where work will be in the future, you will quickly find many service providers developing their existing skills and experience to complete the task. GOVERNANCE: The more recent ministry role of regulator/contract monitor has worked very well on several of the projects that we work on. We provide the horsepower to get the work done and the ministry steers the ship.

P4	This process seems to be extremely high level and focused on the business model or paradigm of the current funding, governance and delivery models. I hope that the next steps open up avenues for discussion about the highly technical issues that inventory also faces.
P5	Works for me.
P6	I notice nothing specifically discussing communication in the Next Steps. Is this on purpose or…? A communication plan or newsletter might be something that could aid in informing ministry, non-ministry, licensees and consultants alike what is going on. Maybe ask for submitted articles from various inventory practitioners or users?! Especially now that the inventory program is back with MoFR, communication would probably be something good to do!!!!!
P7	No comments regarding the next steps.
P10	Need to develop a communication plan which establishes what the inventory group provides, and who they are. Defines the roles and responsibilities of the District, Region and Branch. Defines the expectations of the inventory – it's applications and limitations etc. Working group should be open to other agencies and industry, to get buy-in and share resources and recognize efficiencies. After-all inventory can serve more then timber supply needs. I believe the working group should be made up of Provincial and Regional/District Reps from both government and industry who would be responsible for establishing standards, priorities, ensuring compatibilities of data, researching alternatives collection methods and technologies. I would be interested in participating in the Inventory Workshop to be held in May 2006
P12	Work in small "break out" groups at the workshops should be facilitated but not pre-determined or overly influenced by moderators. The focus of the inventory review should be on the desired results in response to clearly identified information needs of different stakeholder groups and different time horizons. To maximize the return on investment in the vegetation resources inventory a high degree of coordination is required. This is a role government could and should fulfill. The implementation of the inventory should be left to industry and the private sector to stimulate the development of an innovative technologically advanced forest inventory sector. The role of government should be to create an environment in which innovation is at least encouraged so that the value of its investment is maximized. An overseeing role rather than a controlling and implementing role seems more appropriate for the MoF.

	This point is perhaps better phrased as a question – what is the envisioned role of government in the design, implementation and quality assurance of a new inventory program? This may apply to other stakeholders as well including industry, academia and the consulting community which supports forest management in B.C.
P13	Communication Strategy: Districts would appreciate being kept informed of developments and progress as the IPR is conducted
P15	• For steps 5 and 7, there should be money made available to help fund the face to face workshops. • Reading through this paper, I get the impression that some people may take this opportunity to justify an increase in inventory personnel based on past business and expectations. It is imperative that we re-design an inventory system that meets the important business needs (may not meet all needs) and does so in a sustainable manner. In my opinion, the current system can be made more efficient and still deliver a valuable product.
P16	I think the VRI will have limited relevance as long as its purpose is solely to assist in decision making at the MU level. Scrap the Phase 2? Get more flexible on the data that can be used to adjust the inventory (cruise plots). Start Monitoring the inventory.
P21	• Need to consider the role of G&Y Co-ops and IFPAs. They are valuable resources for providing insight and experience into inventory-related problems and solutions. The Forest Resource Evaluation Program may also be a valuable tool in monitoring long-term inventory values. Input from district tenures staff: • Need better VEG inventory for spatial fit of new tenures or transfers (E.g. finding shortfalls in inventory that will not meet licence volume requirements, therefore necessitating finding the volume elsewhere). Accurate inventory and depletions will provide better guidance for tenuring success. • Site productivity mapping required to allow prioritizing Forests for Tomorrow rehabilitation/reforestation projects on wildfires, MPB-killed stands and marginal stands • Issues: Age class 2/3/4 mortality, deteriorated stand fall down rates and mid-term timber supply falldown mitigation strategy (Dave Coates' Basal Area Mid-term timber supply) – each of these studies could necessitate changes to inventories and have TSR implications • Growth and Yield studies are not relevant in a dead forest, albeit MAI of immature stands for next TSR will be of continuing future interest • Non-timber resource interests and inventories will be of importance to Vanderhoof (i.e. deferred harvests, conservation/retention areas)

P23	I have a couple of things in general to add to the excellent job that you have done on this paper. Out of every review of the program I have read each review comes back to 3 main themes. 1) What standard of accuracy do you require for the inventory. You need to pick it and get on with it. Licencees are using the current inventory for cut block planning, and gov't employees are using it for landscape level plans. In both case the data is not accurate enough to do either. Read other reviews for data accuracy. They will include heights, species, crown cover, etc. 2) Funding. Prior to MPB we had a continuous source of revenue to the Province of British Columbia from forestry to fund just about any inventory program. Now we are on borrowed time. If you do not commit and start the inventory program while we still have pine revenue coming in we will not have the where with all to complete any inventory program within the next 40 years. So whatever the province decides do get on with it or just call it done. But stop fooling around with band aid inventories. 3) You have to start integrating the new inventory with other needs such as SARA, UWRs, PEM and TEM etc.. Unless you are really committed to accomplishing an inventory DO not include me on your provincial committee. If you are going some where with the program I will participate in your working group.
P29	1.It is appropriate – will only be useful if recommendations are somehow based on a real desire to have a sound provincial inventory and can be supported and funded just for that purpose. 2. no comment 3. no comment 4.no comment 5. I think the inventory as designed (if properly implemented) is able to fill the 'inventory' needs. It will not fulfill monitoring or change management needs – was not designed to do so. Will not fulfill specific population needs but is designed to accommodate their inclusion. 6.Should apply to the province – not necessary for the inventories to be to same "standard" – they can serve as the Phase I estimate – sample to adjust to provincial standard. 7. Accuracy should appropriate for an "inventory" – OK at the sampling unit but highly variable at the polygon. There are processes to help this in phase I as well as in sample selection, sub sampling, etc. etc – they simply need to be allowed and somehow accommodated.

P31	Electronic update is feasible and innovative, but also limiting as it is difficult to automate entirely. Where do we want to move it from here. I am aware of some initiatives, but not sure if they are getting a true business analysis? I think we need to look at alternatives to what we have. There are so many specialists in the current inventory programs that it may become difficult to sustain once they retire. We need to simplify the methods and work with other ministry's, which I believe is underway, but currently the innovation seems to have slowed. Please understand that being on the outside we tend to be left in the dark a bit unless we are actually involved in a project. Focus and challenge options; identify and evaluate risks, assess and evaluate the financial impact, identify the intangible benefits. We have been working in forest inventory for 12 years and 15 of our 70 full-time staff work in this particular area. Currently we are working for several government agencies and different ministries. We feel we could provide better insight in a less structured forum, where we are provided more background information. As a forest professional the future in inventory does not look positive, and there appears to be an exit out of this sector. The companies that used to be involved have mostly left, downsized or are working out of province or country. Inventory doesn't seem to be a priority for funding, hence the variability in the funding. There needs to be better co-ordination with the oil and gas sector. A few different groups in government are doing this, but the activity is slow as the dollars don't seem to be there. There are several empires within the provincial government that control the inventory. This is typical of any large bureaucracy. The reduction in the size of government has been good because the empires have started to shrink and have been forced to work together. I am not sure if new funds invested in the government work force would help the situation, or if those funds should be awarded to licensees or private companies on 3 or 5 year contracts. The longer-term contracts create some stability and enable new skills sets to be developed – outside of government. The existing government employees are doing an excellent job of quality control and regulating the works. We have developed skills sets in inventory that we provide to several different government agencies and Ministries, but the funding is variable and it is difficult to keep the skilled staff that we develop as we jump from one agency program to another to try find some stability. If a strategy can show where work will be in the future, you will quickly find many service providers developing their existing skills and experience to complete the task. GOVERNANCE: The more recent ministry role of regulator/contract monitor has worked very well on several of the projects that we work on. We provide the horsepower to get the work done and the ministry steers the ship. **Your exercise is timely and we support your intent.**

P32	I would be happy to represent the OGC on any working groups to provide direction for inventory initiatives. There is a critical need for multi-resource stakeholders to have a common inventory and information base to plan multiple uses of the same landbase.
P33	Funding is an issue and the actual costs involved and benefits gained.
P35	How will the IPR ensure linkages to other (incl. new) provincial resource strategies are adequately considered?
P37	Be realistic in your next steps.
P38	Next steps look fine to me.
P40	Looking forward to participating in the face-to-face workshops.
P41	There are some high expectations for this IPR review. Presently as issues arise a common statement is "wait for the IPR review". I hope the review is up to the challenge. I sincerely hope this review brings about some positive changes in the inventory program that will re-focus the program and get it back on track.
P42	In general thank you for this opportunity to respond to this issue. I have spent ½ a day responding in what is an extremely busy time of the year and as a result my answers are not as comprehensive and well thought out as I would like them to be. I feel that this topic is extremely important to the proper management of BC's forests and yet at the same time, feel that this opinion is not widely held. It is up to all of us to raise the profile of inventories and it is my opinion that the best way to do so is by making them operationally useful. When people can see the day-to-day applications then there will be a greater willingness to support investment in maintaining and upgrading them from amongst a much broader community. If this does not happen, then inventories will continue to be considered as the responsibility of a few specialists working in a somewhat arcane subject area … with the result that they will continue to ask the question – who needs it anyway. This is a legitimate question, since obviously it is not of much use to most practitioners as far as they can see, other than perhaps the calculation/determination of AAC, and other than for making nice reports on the state of the forest, the interpretation of which is all very vague in any event. This to me seems the harsh reality. I have done the best I can in the time available. This is such a big topic. I was in a bit of a hurry so that my remarks may not be altogether in the right places. I have included a paper I wrote in 2003 (not for anyone in particular but for anyone who would be willing to listen ... I thought *someone* might be interested. Thanks again for giving me the opportunity to respond. I would be happy to assist in any follow up workshop discussions. ***Note: PDF Document "Inventory Design Concepts" part of this submission***

P44	A cautionary note about handling the outputs from the face-to-face workshops: a distinction will need to be made between interests of stakeholders/users of inventory data which are limited to the areas in which they operate and those interests of gov't which are larger in scope, must represent all users, and reach further into the future. Any recommendations and options must properly account for the big picture, especially as only public funds are likely to be spent on forest inventories on TFLs, TSAs, and Parks/Protected areas in the future.
P45	Communication Feedback process required to keep respondents to IPR informed. Suggest an e- information bulletin following each step.
P46	6.4 – will there be an opportunity to submit responses/comments on the progress report #1 prior to the workshop? 7.8 will the options and recommendations be communicated out? Will the MoFR executive decision be communicated out? What about an action plan post executive decision? What about a timeframe for this executive decision? Without a goal post this step has the potential to drag on and on, fading in our memories.
P47[9]	Large meetings ensure the most vocal people are heard but not necessarily the most knowledgeable. Further, not everyone has great enthusiasm for "Challenge Papers". Have you considered face to face interviews in small groups. In summary, 1) Plough phase 2 dollars into more ground calls for phase one. 2) Start a CFI/monitoring program. 3) Just collect a subset of attributes on parks etc. 4) Finally, don't try to be all things to all people.

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[9] Delayed Response—received after first compilation.

Other Comments and Feedback

OTHER COMMENTS	
P31	There was no discussion on Barriers to moving forward, Substitutes, Strengths, Opportunities or Weakness that should be considered. This might be a more effective way of opening up the discussion. We have been working in the forest inventory for 12 years and 15 of our 70 full-time staff work in this particular area. Currently we are working for several government agencies and different ministries. We feel we could provide better insight in a less structured forum. I will edit my comments as I did some more reading and noted that more meetings are planned. SWOT works well, but if we are also developing strategy we should incorporate some of Porter's 5 forces (barriers, threats, and substitutes). I believe that accurate inventories are a cornerstone of sustainable resource management. They also overlap with monitoring - another important topic. The problem with inventories of dynamic values is that the inventories quickly become dated - not so much for trees, but certainly for the vegetation as a whole. Consequently, I believe that inventory, and monitoring, should be closely linked to ecosystem-level models (not tree population models) that can give you expected vegetation development, at the site series level, of stand structure and vegetation composition (by life form and dominant species). Such models can be used to create probable trajectories of vegetation development between re-inventories, and provide improved input for planning. These models should be capable of predicting in general terms herbs, shrubs and trees in even or unevenage stands, monocultures or mixtures, various scales of mixtures, and incorporate the consequences of management of natural disturbance. Where bryophytes are important - for ecosystem function of wildlife habitat - the models should be able to represent this. There are few models available that can do all this, but there are some and I believe that your review should include a consideration of this class of decision support tool and plan to link one or more to inventory and monitoring programs. I have a manuscript that I hope to submit to the Forestry Chronicle soon entitled "Smart Monitoring" This was developed for the Saskatchewan Forest Impacts Monitoring Board when I chaired this. It specifically addresses the linkage of inventory and monitoring to models and decision support tools.

P5	Here is my IPR feedback form. My comments/answers speak specifically to the needs of the Protection program and some ideas as to how we can work with Inventory Branch to develop a strong partnership that meets both agencies needs. I see this partnership as a win/win as both agencies have a need to acquire and share information. Although I have a strong background in G&Y and SIBEC I have not commented too much on these topics as Protection would be an end-user of the data. The Protection program looks forward to working with Inventory Branch and I am definitely interested in attending the workshop scheduled for the week of May 15th.
P35	I would be interested in participating in future discussions, if the need arises for a consultant with experience in VRI phase 1, 2, and NVAF, as well as growth & yield and appraisal cruising.
P14	My only comment is that I hope this process is not just a course of action to justify predetermined outcomes based on preconceived notions. Thanks for this opportunity to address your Challenge paper on the VRI. I wanted to forward a copy of the feedback form to you as I do have some criticisms (hopefully constructive) about some of the tone of the paper. I'm hoping that the end of this course of action results in both improvements in the VRI process and a wider understanding by FAIB staff of current local planning initiatives.
P17	Following our conversation on the VRI adjustment yesterday, after giving it some thoughts, I think I need to clarify my position. On your question: "Do we need to adjust at all?" A VRI program on an average size management unit (1 million ha) would cost (roughly): Phase I: $1,000k Phase 2: $200k NVAF: $50k Total: $1,250k That means the adjustment (Phase 2 + NVAF) costs about 20% of the total cost Would that money be better spent on extra work for Phase 1? The adjustment doesn't help the licensee or the timber supply analyst. It gives the tax-payer the fuzzy warm feeling that things are OK. The question we need to ask: "15 years after the Peele Commission, does the tax-payer still care?" On your question: "Do we do more harm than good by adjusting?"

	Let me remind you that the VRI is supposed to answer two questions: i) How much? and ii) Where? It is an Inventory Branch imposed constraint that the same tool (the ratio of means) is used to answer both questions. That doesn't need to be. The design committee knew this. Once we have the answer to "How much", we should use professional judgment (with various mathematical tools) to answer "Where". Inventory Branch's constraint might have done more harm than good. But this is not the VRI design's fault. The question we need to ask is: "Do we do more harm than good by adjusting the way Inventory Branch is recommending?" On a final note, let me suggest something. Interestingly enough, the MoFR has never done any research on the VRI adjustment. All the questions we have could easily be answered by doing an extensive simulation project. It would probably cost $50k-$100k to generate a realistic management unit and simulate different sampling and adjustment scenarios. We are talking peanuts compared to what is spent annually on inventory projects in BC.
P22	I do not have time to thoroughly review the paper and fill out the response form at this time. However, I would like to raise the issue that we would like to discuss opportunities to discuss how plants of significance to First Nations can be incorporated in the inventory system (e.g. level of detail to collect, format for distribution of data to be useful to FN for LUP processes and addressing forestry referrals etc.) Please send us an invitation to the mid-May workshop.
P27	I have several views I would like to get across, and I hope I will be able to communicate them without being long-winded. I have some comments below. Comments: On page 2; Expected outcomes: I think we should add two more points to the list of expectations, i.e., Provide a clear statement on the relationship between monitoring and inventory. Does inventory have to be separate and different from Monitoring? (I provide a more detailed comment on this.) Explain the role of Inventory/Monitoring in sustainable forest resource management. I would consider this dialogue a success if it will result in an efficient system of data gathering that will encompass critical forest resource attributes, which may not necessarily be aligned. By this I mean a system that will allow the collection of data on timber attributes, but also provide an understanding of what factors can adversely affect the resources in an expected way, and can be tracked to provide early warning of potential disasters such as Mountain Pine Beetle attacks.

Page 4, section 3.2, sub-section 7c – defining the vegetation Inventory: The current inventory system does not track how the resources change through time. It only states how much is there and where it is. The update system projects three inventory attributes: Stand Height, Stand Age, and Stand Volume. In addition update maps harvest & catastrophic depletions. There is no major reconciliation between projection and depletion, so it is difficult to tell if we are achieving sustainable timber resources management.

Page 5, section 3.2, sub-section 9: The attribute adjustment process is fairly new and quite innovative. BC is probably one of the few jurisdictions doing it. The purpose of the adjustment is to remove bias in the photo-interpreted attributes. It is beneficial and provides information which is more accurate than what is provided by photo interpretation at a reasonable cost.

Page 5, sub-section 3.2, sub-section 12: There are three types of inventory, i.e.,

point-in-time inventories, where new data is collected every 20 to 30 years. At each cycle, the old data is abandoned and is replaced by the new data.

Continuous forest inventory, based on permanent sample plots, which are remeasured periodically

A combination of b) and a), where the inventory is founded on permanent sample plots, but new ones are added periodically.

In BC we have been implementing option a). The first major inventory was initiated in the 1950s and never covered the entire BC forested land base. The emphasis in that inventory was commercially viable species and areas which could be harvested by the technology of that time.

The second more comprehensive inventory occurred between 1961 and 1977. It was a very intensive exercise and data was collected from 50,000 different sample locations. Even then, only mature stands were considered, and was not totally completed due to high cost. Due to the massive nature of the undertaking the sample locations were not selected randomly to reduce cost. This in fact is the main criticism of that inventory.

The VRI was implemented in 1996 approximately 19 years after the last completed inventory of 1961 to 77. The similarity of the VRI to the previous two inventories is that it too is a point-in-time exercise. In most cases, these inventories become obsolete in a very short time. They are not amenable to constantly changing resource information needs. As a case in point, the VRI cannot answer some of the questions arising from the MBP epidemic.

In the US forest service, they have implemented option b) and rather than visit their sample locations once every, 10 years or so, they annualised it so that they can visit 10% of the locations every year. For budgeting purposes, this works out well, because they have conditioned their executive to spend a fixed amount of money every year for inventory.

Option c) is what has been called sampling with partial replacement. It was severely criticized in the 1980s, but increasingly, people are seeing its potential benefits.

Option c) combines monitoring using permanent sample plots visited regularly with inventory estimation, which is a point-in-time exercise. In my opinion, moving to this combination of inventory & monitoring would be an ideal situation because it is efficient and could save a lot of money in the long run, while allowing for monitoring of long term resource use. It would also allow us to address issues raised in sub-section #14

Page 6, sub-section #16 b): The issue of legislation has been over-complicated. It may not be necessary to modify the Forest Practices Act to achieve what is required. It could be as simple as an internal communication defining the roles of different agencies, be they private or public in delivering the inventory program. A change in the Forest Practices Act might take years to accomplish.

Page 7, sub-section #17: The mountain pine beetle epidemic was not a major issue when the VRI was developed. As such, the collection of data on dead trees was not a main objective. Now dead wood is as important as live tree wood. This means the VRI has to enhance dead wood data collection even in inventory units where MPB attacks are not an issue.

Page 7, sub-section #19: OAFs are used to adjust outputs from models developed using biased or superficial data. They adjust the model outputs to reflect reality. Surprisingly, the OAFs used to adjust the TASS model are not based on data collected here in BC. There is a need to localize these OAFs, but I am not sure of jurisdictional responsibilities.

I would suggest adding a sub-section #20: Adjusting inventory attributes for completed VRI. The VRI design committed us to adjusting photo interpreted timber attributes based on data collected from ground sample locations. The IPR should confirm this commitment. In this regard, I would suggest that the providers of inventory information be required to provide adjusted inventory attributes to meet the VRI standard.

Minor suggestion: For sections chapters 3 & 4, it would have been a good idea to ask questions of the reviewers after each sub-section. For instance, for section 3.3, sub-section #1, it would have been a good idea to ask the readers one or two question, e.g., "Do you have any other ideas on what role this sort of review might serve? …just a thought.

On the issue of Monitoring: This should have been given more detailed coverage, possibly in section 3.3. We need to ask some very fundamental questions about monitoring. There are many issues that need to be clarified. Please consider the following:

Is our current definition of monitoring, which is "checking a prediction" appropriate? What does checking a prediction mean?

What should we be monitoring and for what purpose? There are several areas where monitoring could be helpful. These include reconciling depletion with growth. If depletion exceeds growth, then resources are not being managed sustainably. In any given year some management units experience several types of resource depletion, e.g., fires, harvesting, insect attacks, blow-down. In fortunately, we do not a system in place that balances what was in a management unit at the beginning of the year, and what is left after all the depletions have occurred. The only thing the inventory captures is the opening created by depletion. The data associated with depleted resources may or may not be maintained by a number of agencies outside the inventory program and never gets back to us. There is not reconciliation between loss and what was there before, and information on growth is not available to allow a check to see if what was depleted is less than or equal to what was added as growth.

Whose responsibility is it to monitor pest infestations and estimate the potential effects of major out breaks? There is lack of clarity on this. Is it possible to build an early warning system through a monitoring program? The current outbreak of MPB got out of hand because we have no systematic way of verifying impending pest hazards. When this outbreak started, we relied on anecdotal information to make decisions. People in the field were encouraged to do nothing about the outbreak because an earlier one in the 1980s had started and ended naturally without human intervention. When it became clear this particular outbreak was more serious, the global warming was blamed for the spread, but in reality, some preventive measures could have been taken to reduce the rate of spread and perhaps prevent the current tragic circumstances.

Considerable resources are invested in replanting depleted areas, weeding and spacing to ensure success of new forests. Is it possible to check if the return on investment is worth the effort going into it? How can we establish a mechanism for checking on growth rates for second growth forests? The document should provide more discussion on this.

Who is responsible for collecting inventory data or monitoring the state of resources in Parks, Reserves and other public lands that are not under timber supply management? Are these areas eligible for resource use/depletion and pest infestation monitoring?

How do we track sustainable resource use at the provincial level? Do we use the National Forest Inventory plots to do this, or should we establish management unit level monitoring systems?

The extent or scope of the provincial land resources inventory is not clearly defined. What lands are eligible for inventory? Should we be just concentrating on timber harvest areas only? Should we be collecting data from swamps, alpine areas, hay fields, and pasture lands? If the inventory branch does not collect that data who does? Do these areas of no commercial interest have business drivers? If so what are these drivers?

Integration of forest and non-forest resource monitoring: A discussion paper on this issue was started sometime in 2002, but due restructuring, the initiative stalled. A copy of the discussion paper is attached as Appendix A

Page 9, Assumption #2: The debate on strategic vs operational inventory is a bit miss-leading. It is really a debate on the size of unit being considered. If one is establishing a cut-block which is 5 ha in size, it is possible to establish 10 ground plots per hectare thus obtaining very precise information on the cut-block. If one has 1 million hectares of land to do an inventory on, however, it is not economically feasible to apply the 10 plots per hectare sampling intensity. Surprisingly, 50 plots locations in 5 hectares might produce the same sampling error as 50 plots in 1 million hectares if the variability of the attribute of interest is the same for the two situations. The accuracy, of inventory data at a polygon level is mostly limited by lack technology to capture accurate estimates of attributes on a large scale. But even with the current technology, the lack of accuracy should not preclude the use of the data for spatial analysis. In this regard, some investment in more sophisticated remote sensing technologies might be worthwhile. Unfortunately, it is difficult to venture into experimentation when benefits are unknown and competition for limited resources is intense.

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APPENDIX A

Project Announcement
Ministry of Sustainable Resource Management
in Partnership with
Other Provincial Ministries

An Integrated Environmental Monitoring System (IEMS)
for British Columbia

Phase I: Strategy Framework

January 30, 2002
Project Title

A Strategy Framework to Support the Development of Integrated Environmental Monitoring System (IEMS) for British Columbia (Phase 1)

The term environmental is being applied here in the broadest sense and from an environmental sustainability perspective. As such, along with the consideration of ecological or biophysical qualities, there is the need to address the monitoring of some social and economic factors. For example, in sustainable forest management there is the goal to maintain and enhance the long-term health of forests while providing ecological,
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economic, social and cultural opportunities for the benefit of present and future generations10.

Background

This project has been initiated in response to the widely recognized need within government, across the province and nationally to take a more "corporate" approach to environmental monitoring. Currently there is a plethora of monitoring and monitoring-related activities within government, the private sector and non-government organizations. While all well intended, there is an opportunity and necessity to consolidate these efforts. There is a need to design and implement a more rational, coordinated and integrated system that will be more effective and efficient.

More specifically, this initiative is in response to the findings of a study titled — Environmental Monitoring: Business and Information Needs11. Some of the key issues identified in the study include: monitoring information supply – demand imbalance, lack of formalized business drivers, technical capacity shortfalls, indicator proliferation, lack of coordination, weak linkages to decision-making processes and the need for more effective partnering to support the monitoring function.

Purpose

Development of a strategy framework for the design, development, implementation and performance assessment of a province-wide, integrated environmental monitoring system (IEMS). The framework will provide context and linkages to the closely allied support functions provided by resource inventories, surveys and research.

Project Scope

The strategy framework needs to address province-wide needs for environmental monitoring. It also needs to embrace a broad range of monitoring requirements including the assessment of the effects of resource development, management activities and natural events that affect the environmental quality and quantity of water, land, air, biota and human well-being.

The framework will embrace all aspects (functions) relating to environmental monitoring. Following the adaptive management construct, these include: assessment (of the monitoring requirement); design; implementation; monitoring; evaluation; reporting and communications; and adjustment (of policy and practices).

Resource inventories and resource surveys provide important information to support the environmental monitoring system. Research activities likewise support the environmental

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[10] Canadian Council of Forest Ministers (1992) definition of sustainable forest management.

[11] Prepared for Land Information and Inventory Coordinating Committee, Province of British Columbia by Daryl Brown, Daryl Brown and Associates Inc. and John Dick, Sustainable Visions, March 30, 2001.

monitoring system. They provide an understanding of the causes and consequences of changing conditions including an understanding of the significance of interactions among resources, their linkages to variations in the natural and human environment and their response to multiple drivers of change.

IEMS Initiative Phases

Phase I will create a strategy framework for developing an Integrated Environmental Monitoring System. This phase will be internal to government but will nonetheless embrace a wide scope, as noted above. Phase I will be completed by March 31, 2002.

Phase II, guided by the strategy framework, will widen the consultative process and engage a wider set of client-stakeholders beyond just government. It will include obtaining feedback on and refining the framework components, developing the IEMS Strategy for BC and developing an overall and near-term (more detailed) IEMS Implementation Plan.

Phase III will begin the incremental implementation of the IEMS. It will likely start with some pilots and testing of key components of the IEMS; rationalization, integration and coordination of existing environmental monitoring activities; development of important partnerships and infrastructure, etc. A key component of the IEMS will be the monitoring of the IEMS itself in terms of first, progress with the implementation, and second, the regular assessment and reporting of the systems' effectiveness.

Key Tasks & Schedule:

Situation analysis update — at a strategic level, assess and update various situation analyses regarding the state of current monitoring; assess implications of government restructuring, and the effect of changed mandates and delivery models on monitoring business drivers, functions, roles and responsibilities, etc.

Research other environmental monitoring models and frameworks — undertake a cursory scan of other jurisdictional activities that can offer possible frameworks, structures, definitions, processes, etc. for this initiative (e.g., Ontario, US, Australia, elsewhere)

Prepare a Discussion Paper outlining the current circumstance and envisioned requirement in the short-, medium- and long-term; the anticipated process, major components, roles and responsibilities; and related elements (late February)

Conduct a Workshop with key government client-stakeholders to — confirm scope, definitions, principles, vision, strategic objectives — i.e., an agreed upon strategy development framework; confirm process steps to March 31, 2002; discussion paper will serve to structure and guide these outputs of the work

Develop Strategy Framework document — transform the Discussion Paper into the Strategy Framework with the benefit of the workshop input on the major components/elements, processes, issues, opportunities, schedule, roles and responsibilities, and overall integrating model.

	Example of Strategy Framework Components: Purpose, Background Scope Definitions Principles and Vision Strategic Objectives Governance Establishing Priorities Process Resources, Roles and Responsibilities Performance Management, Change Management & Accountability Implementation Plan — near term (April – September 2002), medium-term (September 2002 – March 2004), Long-term (2004+)

P28 Memo To: Inventory Program Review (IPR Responses) Committee

As the and **Challenge Paper**, *Eight Keys to Productive Dialogue*, suggested engaging in *"out of the box thinking"*, please accept this format of placing our comments into boxes of our own.

Item #	Pages	Topic	Comments: Challenge Key Expected Outcomes Assumption Statements Critical Questions
1	vi	**Ecosystem Mapping Challenge Dialogue**	The report mentions an MOE, Ecosystem Mapping Challenge Dialogue .. (PEM)?with a similar timeline as the Inventory. When will this occur?
2	2	**Clear Strategic Direction**	There is a call for a renewed *Vision, Mission Statement and Mandate* for the Inventory Program... Where can we find copies of the current strategic direction? These should be posted on the home page of the FAIB web-site
3	3	**Recreation**	The *Review of Inventory Issues in the TSR Process* identified the need to clearly define the Roles and Responsibilities regarding inventory, between MOFR, MOAL (ILMB) and MOTSA. This statement should be expanded to include the MOE (PARKS Branch), as Recreational Inventories within Parks contribute to the assessment of the entire Recreational Opportunities Spectrum (ROS).

			The statement should also be expanded to include need to clearly define all the Roles and Responsibilities MOFR, MOAL (ILMB),MOTSA and MOE (Parks Branch), as currently there seems to be a great deal of confusion amongst the Public and Government Employees.
4	5	**VRI Time-frames**	Timeframes may be shortened by overlapping photo and field work. Time and Costs efficiencies may also be gained by awarding Multi-year, Multi-Phase contracts, but the current funding model does not allow for this. Managing a Multi-year, Multi-Phase program based on Annual Vote Funding, is challenging, time consuming, and inefficient.
6	7	**VRI_NVAF Net Volume Adjustment Factoring**	Recently, *Revenue Branch* has approved the use of a valuation fix for all balsam stands in the Interior subject to a further verification study. One component of this study is to review the feasibility of collecting interior log grades during NVAF sampling Currently, the NVAF portion of VRI sampling only collects coastal log grade information on the destructive samples. The relevance of NVAF sampling would be enhanced, if the data collected is compatible with BC's interior log grades. This would then essentially be compatible with BC's stumpage system, which is predicated upon estimating the sawlog vs. pulp volumes of stands. Adjusting the net merchantable volume estimates of a stand via NVAF is only useful if the sawlog vs. pulp split is collected at the same time. This is another example of where Revenue Branch and FAIB, could increase their levels of collaboration and cooperation, in order to meet mutually beneficial goals and objectives. Recommend: 1: Collect interior log grades on all future VRI_NVAF sampling 2: Change VRI_NVAF standards to facilitate this. 3: Investigate the feasibility of converting coastal log grades to interior log grades for completed NVAF samples

7 a	5 16	**PEM and SIBEC**	Recommend: The VRI polygon delineation process should be enhanced to address critical bio-terrain breaks, to ensure efficient and effective field data collection for the VRI, as well aid in facilitating further Predictive Ecosystem Modeling (PEM) processes. This process should reduce or eliminate cross product (VRI /PEM) polygon slivers, and enhance the likelihood of the PEM product meeting the 65 % accuracy standard. This PEM product can then be used to update productivity curves for growth and yield modeling using SIBEC adjustments for each site series.
7b		**Base Mapping Geomatics Systems Standards**	There is a need to clarify, document the standards relating to the Air-Photo scale is correlated to the standards required for their end use. These standards must be clearly communicated to all parties at the earlier possible stage of all inventory related projects, including TRIM updates, Orthophotos, PEM and VRI. i.e., 1:35,000 color photos do not meet the standard for VRI, but may be acceptable for Orthophotos and TRIM 2.

P49[12]	I thought about what I might contribute to the dialogue about updating the methodology for conducting vegetation inventory in BC and came to pretty much the same conclusion as you outlined in your e-mail. I have already said pretty much anything relevant that I have to say via that MPB submission I made previously. As you suggested, I have dusted this off and resent it with this little bit of a covering explanation. Basically, my position is that this dialogue should consider designing a forest inventory system that was temporally dynamic and utilized transactional updating to maintain a constantly updated and relevant inventory of forest cover site conditions at the stand level. My contention is that a one-time effort to define fixed spatial entities of relevance for forest management (let s call then forest stands) could form the basis for an on-going effort to maintain this spatial database through transactional update procedures. In many ways, this one-time effort to define stands has already been done as VRI and/or FC. With respect to this activity, I direct your attention to a paper that just came out this week in PERS by Michael Chuby, Steven Franklin and Mike Wulder, who I am sure are already contributing to this Challenge Dialogue. I thought that this paper did an excellent job of outlining the benefits of extracting, characterizing and classifying spatial objects identified as forest stands and of showing how this can be accomplished automatically (here using

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[12] Delayed Response—received after first compilation

e-Cognition). I would strongly support any suggestions contributed to your challenge dialogue by these authors that involved extraction and characterization of forest stand spatial objects. This concept is entirely in keeping with the suggestions that I included in my contribution to the previous Challenge Dialogue.

You then need to be able to update (change) the boundaries of any defined stand that has its boundaries radically changed (e.g. by harvesting or by natural disturbance such as fire or disease). Generally speaking, you would expect that only a small proportion of stands would experience changes in their boundaries in any given year. You want a procedure for identifying all stands that experience significant changes in stand boundaries and for updating the boundaries of these objects to define new boundaries (and new objects if only a part of a stand experiences change). I could see analyzing coarse resolution (MODIS or ASTER), multi-date (monthly or 15 day cycle) satellite imagery analyses on a yearly basis to identify spatial objects (forest stands) whose characteristic signatures had changed so dramatically that they had obviously undergone a severe disturbance (e.g. harvesting or natural disturbance). Based on this initial screening, I could see obtaining higher resolution imagery for these changed stands and using this higher-resolution imagery to inform a process in which the boundaries of the new changed entities were recorded and the new spatial entities were entered into the spatial database (with their new characteristic signature attributes) for on-going monitoring.

You then also need a mechanism for monitoring continuous and incremental change in stand characteristics for those stands whose boundaries have not yet experienced any major change. For these stands (or objects), you really want something that will act like a growth and yield monitor to support or corroborate estimates of the change in stand characteristics that you might be making based on some growth and yield model. I think that this could be accomplished by collecting and analyzing coarse resolution (MODIS or ASTER), multi-date (monthly or 15 day cycle) satellite imagery on a yearly basis to get an idea of the change in stand density and vigor as inferred from this multi-date imagery rolled up within each defined forest stand object. This approach lets you try to keep track of the pace and magnitude of on-going, incremental changes in stand characteristics for all those stands that have not experienced a dramatic change in any given year (e.g. been harvested, burned or infected). I actually think this could work.

That pretty well summarizes my main ideas on what I would suggest be considered when discussing new approaches for forest inventory in BC.

I hope that you can find some use for this contribution. I am not looking for work in this area and really have not established any presence or reputation in the area of analysis of satellite imagery for forest classification. I just thought that I might be able to provide a different perspective than someone who is more heavily involved in traditional forest inventory operations. I do not work in this area but it has peripheral relevance and interest to what I mostly do with automated classification of landforms and ecological spatial entities. I tend to be a bit of a lateral thinker and I would say that this is an example of my thinking laterally to explain how I would try to approach a problem that I would not normally tend to deal with using ideas and approaches that I do tend to use in addressing the other different problems that I do regularly address.

I hope that you can find some way to include this submission in your discussion and problem analysis. I am basically arguing that you should try to define an inventory methodology that is ongoing and that involves maintenance on an on-going basis of up-to-date information on forest cover at a stand level through continuous monitoring and transactional update of a database of forest stand information. I argue for no more one-of snapshot forest inventory projects but rather for a systematic and on-going program for constantly monitoring and updating the characteristics of forest stands (for whatever my opinions are worth).

Changes in Land Use or Land Cover

Introduction

The challenge of how to create, maintain and update spatial databases that provide information on changes in patterns of land use and land cover across very large areas is one that has interested me for some time.

I began thinking abut this challenge quite seriously in about 2000. My interest at this time was in devising a mostly automated system that could recognize, classify and map changes in agricultural land use for an entire province in a manner that was technically feasible, accurate, efficient, and affordable. To my mind, a spatially explicit database of land use was perhaps the single most important spatial database that was not available in any reasonable form for Alberta, or for that matter for any other Canadian province.

The design I initially conceptualized for that database addressed many of the same needs and challenges that are encountered in designing a spatial database to track changes in forest vegetative cover at the level of either cut blocks versus forest stands or healthy versus diseased forested stands.

In December, 2004, I was asked if I could provide any ideas for a system that would enable the province of Alberta to automatically recognize and extract forest cut blocks in order to automate the process of developing and maintaining a spatial database of changes in forest cover due to harvesting, human disturbance and fire activity.

In my view, the problem of identifying and mapping the spatial extent of areas affected by Mountain Pine Beetle is not terribly different from the problem of monitoring change in forest cover from forested to non-forested cut blocks or fire scars. There is a difference in degree of difference where forest to non-forest is virtually a binary operation from dark (forest) to white (non-forest) while pine beetle damage is somewhat more subtle, but otherwise the problems are conceptually similar.

I provide below a short description of a generic design for addressing the challenge of monitoring and transactionally updating a spatially explicit data base of information on forest cover status.

4.4 Problem Analysis

The main features of the problem can be identified as follows:

Firstly, the problem requires an ability to assess land cover and/or land use over very large areas up to an entire province in extent. The requirement for continuous coverage over a very large area imposes a number of significant challenges in terms of simply acquiring and processing very large volumes of information. It has proven very difficult to produce cloud-free mosaics of satellite imagery for entire provinces even when images could be selected from archives that stretched over several years. Obtaining cloud-free high resolution imagery for an entire province for two or more time periods of similar dates in a single year is likely to be highly problematic. Even if two or more cloud free composite images could be produced for an entire for two different time periods in a single year, the volume of data processing might well prove to be prohibitive in terms of costs and time requirements.

Secondly, the problem of detecting the presence of areas affected by Mountain Pine Beetle and, more generally, of detecting changes in the health and vigor of forest stands affected by Mountain Pine Beetle is complex and is not likely to be well served by analysis of just two different image mosaics produced by compositing multiple images taken at different dates and different times of day and under different lighting conditions and different stages of seasonal growth. Relying on an analysis of differences in simple reflectance values between two images taken at two different dates (or more likely taken over a series of dates in two different seasons) is fraught with hazards. Pixel by pixel comparisons are subject to error caused by registration errors and displacement of pixels in space from their true position so that observed differences arise as much from comparing two different locations as from detecting change in forest cover condition at the same location. Comparisons of change in pixel values between only two dates is likely to be sub-optimal as significant changes may not be readily obvious for all locations at exactly the same two dates. The types of changes that are of interest are far more likely to be discernable in terms of yearly patterns of growth and reflectance for each site than in terms of a simple difference in reflectance values between two dates.

Thirdly, it is important to conceptualize and identify the size, scale and attributes of the object that is of interest for monitoring and change detection. If the object of interest is an individual tree and the desire is to be able to monitor the forest across the entire province to detect and identify individual trees that have been attacked by Mountain Pine Beetle, then the solution must target the recognition of objects as small as individual trees. While this may be a legitimate desire, it is unlikely that anything this ambitious would be feasible to accomplish given limitations of time, budget and available technology. One then has to ask what other objects might be profitably identified and monitored that are feasible and cost-effective to recognize. I would argue that a suitable object to identify and monitor might be defined as a forest stand, or a defined portion of a forest stand. A forest stand can be compared to a farm field. It can be thought of as displaying a relatively uniform composition in terms of type and pattern (density, age, height) of forest cover. Forest stands tend to behave similarly (e.g. age at a similar rate, be attacked by pests at the same time, etc). Forest stands also have the desirable attribute of being relatively large. Let us assume that most forest stands have horizontal dimensions of at least 500 m by 500 m and more commonly are up to 1 km by 1 km in size. If such stands can be identified and spatially located once, they can then form the basis for relatively large objects whose behavior over time can be monitored quite affordably using lower spatial resolution but high temporal resolution imagery.

In analyzing the problem, it is important to consider the utility and cost of using relatively coarse resolution cloud-free multi-temporal imagery that can be obtained frequently, on a short repeat cycle and at low cost versus using higher resolution imagery for which it may be difficult to obtain cloud free images for more than one or two periods of several months duration during a given year. Lower resolution, multi-date imagery, such as MODIS, has several distinct advantages as a data source for monitoring and detecting change in vegetation or other land uses at the scale of interest to the Mountain Pine Beetle problem.

To begin with, MODIS imagery is compiled and distributed at very low cost as 8 and 16 day composites of daily images selected in such a way as to minimize the amount of cloud cover in each 8 or 16 day composite image. An image mosaic can be constructed for an entire province of relatively cloud free images that are all taken within a short 8-16 day interval. The relatively large footprint of MODIS imagery (250 m) means that is it both feasible and affordable to obtain and process MODIS imagery for an entire province on a weekly, or perhaps bi-weekly, cycle. The ground footprint of a MODIS image (250 m) represents a reasonable trade-off between spatial detail and processing volume. If we accept that the target objects of interest are forest stands, and that forest stands are typically at least 500 m by 500 m in horizontal dimensions, MODIS imagery at 250 m footprint will provide a reasonable measure of aggregated surface cover characteristics within most forest stands of interest.

Next, one MOSID imagery product that is distributed is a Normalized Difference Vegetation Index (NDVI) that can be interpreted as a measure of relative "greenness" of the objects that occur within each MODIS pixel. The specific problem of identifying forest stands that are potentially affected by Mountain Pine Beetle, as well as more general problem of identifying changes in type and density of forest cover, are well served by analysis of multi-date images of "greenness index". One can consider that, for example, 12 monthly images of "greenness index" can be thought of as defining a characteristic graph or curve that identifies a yearly cycle of relative "greenness" for each object. This annual greenness graph can be interpreted in terms of kind of ground cover, vigor or health of the ground cover and density of the vegetative ground cover. Over a complete cycle of one year, a relatively treeless forest cut block will display a very different temporal pattern of "greenness" than will a thick healthy forest stand. Similarly, a forest stand whose health and vigor were adversely impacted by infestation by Mountain Pine Beetle would be expected to exhibit a different annual cycle of variation in "greenness index" than a healthy stand. Since the objects we are interested in monitoring are conceptualized as forest stands, the annual cycle of greenness values can be computed for each identified forest stand by computing mean values for greenness index rolled up for each stand at each image date. These mean greenness index values taken together over a yearly cycle form a characteristic curve that describes the cycle of variation in greenness within the object of interest over a year. These curves can be used in a manner that is similar to signature libraries used to identify organic compounds. The yearly greenness curve for any given object can be compared with a library of curves that represent typical cycles of greenness for different cover types. The cover type whose curve in the library most closely resembles the curve observed for a given object will be identified as the most likely cover type for that object. It should be intuitively obvious that a forest cut block will exhibit a different temporal sequence of greenness values than will a mature forest stand. Likewise a stand infested with Mountain Pine Beetle is expected to exhibit a different temporal pattern than a healthy stand.

A key advantage of using multi-temporal image data sets is that the analysis is flexible enough to deal with differences in dates and rates at which greenness (growth) occurs at different locations. Differences in the greenness value observed at different locations with the same cover type at the same date can arise due to differences in climate (temperature and moisture), latitude, longitude, sun angle and illumination and many other factors. Use of an approach that compares the yearly cycle in variation in greenness to a library of reference standards means that different locations can have very different greenness values at similar times and still be recognized as having a similar cover type, if both display graphs of variation in greenness that have similar shapes. The shapes of the graphs can be offset in the time dimension (horizontal axis) or in the vertical dimension (absolute value of greenness) but they can still be judged to be similar and to represent the same cover type, with differences in time due to differences in timing at which growth becomes active and differences in absolute value due perhaps to illumination, shading or even relative vigor of the vegetation.

The problem of detecting and mapping changes in forest cover (or forest health) can be broken down into three main sub-problems. In the first instance, it is necessary to identify and spatially locate objects that one wishes to monitor for change. In the second instance, it is necessary to monitor these objects to identify when they exhibit a marked change in cover pattern, which we here recommend be identified using analysis of low resolution, multi-date imagery. In the third instance, it is necessary to confirm (or reject) the existence of an anticipated change and to update the boundaries of any objects of interest (forest stands, cut blocks) that have been confirmed to have undergone a change in cover type in part or in whole. These problems are not all well addressed by the same data sets.

The first requirement is to identify the objects that are to be monitored for change. The objects can be as simple as a single pixel in an image dataset. For various reasons, it is recommended that detection of change not be attempted on an individual cell basis. For one thing, there is the problem of spatial off-set due to image registration errors. For another, cell by cell comparisons create inordinately high volumes of data and increase processing time. For another, it is the characteristics and behavior of the larger objects of interest (e.g. forest stands, cut blocks) that is of importance for this problem and not that of individual cells. Working with pixel data aggregated within larger object areas equivalent to forest stands provides some leeway for accommodating errors due to mis-registration of images. It also greatly reduces the volumes of data that have to be stored, processed and interpreted. The actual process of identifying, outlining and classifying the spatial objects of interest is time consuming, may require a significant amount of manual human interpretation and will certainly require the use of high spatial resolution imagery. The good news is that this process of identifying initial objects for classification and monitoring only has to be done once. After the initial objects are defined, all subsequent efforts are directed at transactionally updating the object data base by identifying only locations where there has been a change in the character of the object and updating the spatial extent and attribute classification of the changed object. In the case of BC, it may well be feasible to use existing vector data on forest cover (FC or VRI) as an initial starting point for identifying forest stands, non-forest areas, cut-blocks and other spatial entities that will define the objects to be monitored. Existing manually interpreted spatial databases may be supplemented, or revised, through the use of automated techniques for identifying and extracting features or objects from image data (as per e-Cognition).

Once the objects that are to be monitored are defined, mapped and in place, the second part of the equation is to devise an effective and cost-efficient mechanism for monitoring those objects to identify if they have undergone a significant change in cover type or in the characteristics (health and vigor) of the cover type. This part of the problem can best be addressed using high temporal frequency, low spatial resolution image data such as MODIS. It is simply not feasible to acquire, process and interpret moderate to high spatial resolution image data for an entire province on a repeat cycle of several images per year. It is sub-optimum to attempt meaningful change detection using only one or two difference images per year of moderate to fine spatial resolution image data. Finally, it is not necessary, for the purposes of detecting change in objects the size of forest stands, to process moderate to high spatial resolution imagery for each object for each time period. All of these reasons argue for adoption of a monitoring methodology that makes use of lower resolution image data that can be obtained and processed at a high temporal frequency. The point of the monitoring data sets is not to identify the boundaries or extent of changes in land cover precisely, it is only to identify whether a significant change has occurred within a defined spatial object (e.g. a forest stand) that may indicate a significant change in health, condition or cover type. The monitoring acts as a screening mechanism to raise flags for locations where a defined and mapped object has demonstrated a likely change in cover density, type or pattern. Once the broad brush monitoring has raised a red flag, the areas of concern need to be reviewed using higher resolution imagery to determine if a significant change has occurred and, if so, the nature and spatial extent of the change.

The third main sub-problem is that of transactionally updating the database of spatial objects to reflect any changes in cover type, pattern, health or other attributes that are identified by the screening process described above. Objects whose cover type has significantly changed need to be reviewed. New boundaries need to be drawn to partition an original object into two or more new objects if the observed change has only affected part of the previously defined object (e.g. part of a previously healthy forest stand is now infested with Mountain Pine Beetle and part remains unaffected or part of a forest stand has been harvested and pert remains). If the entire object has undergone a uniform change, then only the attributes recorded for the object need to be updated. In order to conserve space and in order to make it easier to track and identify changes in the object data base, it is recommended that only changes to the spatial object data base be recorded for any given time interval. All locations that have not been associated with a change do not need to record updated spatial information. Only those locations where an object has changed its boundaries are recorded, along with the date and nature of the change and the identity of the new spatial object that the location now belongs to. This time-stamped spatial database should be fairly easy to query to identify and display changes in status of the forest between any two dates or to display the current status of the forest at any current date. Since the spatial database consists of a series of relatively large spatial objects (forest stands and the like) it will be smaller and more feasible to manipulate and display than a pixel database of billions of cells. Attribute data need only be maintained for larger spatial objects and not for the individual pixel elements that make up each object.

4.4 Implementation details

1. You need to first define, delineate and attribute spatial objects that are not single pixels but are rather something closer in concept to the objects that you want to monitor for change. In the forest environment, the objects of interest are:

a) Forested stands

b) Cut Blocks

c) Fire Scars

d) Non-forested exception areas (urban, water, roads, rock, etc. - all pretty easy to isolate once and they stay that class thereafter).

e) Pine Beetle affected stands

2. To define these objects, you can certainly avail yourself of existing vector data sources such as VRI, FC and AVI (in Alberta). You probably need to verify these visually against a backdrop of background imagery. This is a big job and might be time consuming and costly but it can be done. JMJ has done manual on-screen recognition and digitizing of readily visible objects for me for pennies a hectare (< 3 cents per hectare). This job could theoretically be automated but it may not be cheaper or faster to look for automated methods of feature identification and extraction.

Where manually interpreted vector maps do not already exist, you can certainly look to using automated feature extraction or object recognition software to automatically recognize and extract spatial objects that exhibit a characteristic spatial pattern in image data. Many people are now familiar with the concept of object extraction from imagery as performed by e-Cognition software. The idea here is to draw boundaries around known or obviously visible areas of non-forest (cut blocks or fire scars) so that you know which areas are in forest (and so can practically change from forest to non-forest in the case of monitoring harvesting activity or from healthy forest into pine beetle affected forest in the case of monitoring Mountain Pine Beetle activity.

3. Once you have these initial objects recognized, extracted and attributed the problem becomes one of monitoring the remaining areas that are designated as forested (at the level of forest stands and not individual trees) to check for dramatic changes in the spectral pattern within the mapped forested entities. In the reverse sense, you can also monitor the non-forest areas to look for dramatic changes that may indicate a return to forest cover from non-forest status. In your case, the problem is a bit more difficult since the changes may not be as dramatic as from forest to non-forest or vice versa. Still, the key is to define the objects first in any case as these objects become the things that you monitor for change (and not the individual pixels in a satellite image).

4. My suggestion here in Alberta (and it would be the same for you) would be to set up a monitoring program that made extensive use of lower resolution, multi-date imagery such as MODIS rather than to try to acquire, process and interpret the many hundreds of satellite imagery scenes that would be required to cover all of BC (or Alberta) periodically. The MODIS ground footprint is only 250 m as opposed to 20-30 for satellite imagery. However, most of the spatial objects that Alberta is interested in monitoring (cut blocks) are larger than 250 m in both directions, 500 m to 1 km would be about normal. So a MODIS image can have its digital values (NDVI greenness level values in the case of MODIS) rolled up to compute a sum within the bounds of each polygonal entity quite effectively. MODIS is cheap to acquire. You can get weekly mean value MODIS images that have been created using the parts of daily images that have the least cloud cover to create a weekly composite "cloud-free" greenness image. Because the images have 250 m ground footprints you can affordably process a composite image for the entire province in a few minutes to perhaps an hour. At this rate you can process images weekly throughout the year in a way that is both feasible and affordable. You cannot hope to do this with any finer resolution imagery (satellite or airborne).

5. Because you roll up the weekly values within mapped polygons, the exercise becomes one of looking for significant (or dramatic) changes in values within any given polygon. Because you have acquired and processed weekly data sets, the process also becomes one of looking at temporal patterns that can be equated to "signatures" that are characteristic of the phonological behavior of the ground cover through time (e.g. through a full year growing cycle). In the case of cut blocks, the yearly greenness pattern is very characteristic with white snow reflected in the winter, rapid and strong greenness in the initial spring flush and then rapid senescence to a brown cover by perhaps August. Forest stands will show a very different greenness curve. I can imagine that a healthy forest stand will have a very different temporal curve than an un-healthy stand affected by Mountain Pine Beetle. These signatures and patterns are observed and recorded at the level of the spatial objects (such as stands or cut blocks) and not at the level of an individual pixel or tree. This makes it feasible to go for province wide coverage on a weekly (or bi-weekly) basis. The temporal signature concept also allows for relative

classifications and comparisons such that the shape of the curve is of greater importance in comparing like objects than the absolute values of the digital numbers. This makes the process much less sensitive to variations in image quality, climate induced differences in growth rates and dates and other elements that will cause confusion if single date satellite imagery is used for change detection.

6. Your MODIS NDVI multi-temporal analysis becomes your tool for screening the entire area (province) to pick out indications of locations where a change may be occurring. It may not be of sufficient spatial resolution to let you map the change, but it may well be enough to tell you a change is occurring within a particular defined polygonal entity. If your screening sends out a red flag that tells you a change may be happening within an object you have defined (e.g. a stand or a cut-block) now is the time to obtain finer resolution imagery for this particular location and use it to examine and verify or reject the postulated change. If a change has occurred, you then need to transactionally update your data base of objects that define stands, cut-blocks, fire scars, etc to break the previous object (e.g. a stand) down into its new components (e.g. a stand and a cut-block or perhaps a healthy stand and an infected stand). You then go back to your weekly monitoring for change with the new objects entered in your database along with their spectral and temporal signature patterns.

7. A fairly efficient way to store changes for only for those areas that experience a change in cover pattern is needed. So, instead of having to maintain maps of cover type at every time for every pixel, you only maintain a record of 2 things. One is the rolled up value within each object which is stored as a data base record tied to the object for a particular date. The second is a database of grid cells that have changed from being associated with one object to another. Only grid cells that change assignment are recorded with the date the change was implemented and the nature of the change (from polygon N of type forest to polygon X of type cut-block). This makes it quite feasible to maintain a very reasonably sized data base of temporally changing conditions.

4.4 Conclusions

The above design is quite generic and could be applied to monitor, for example, changes in agricultural land use of types such as permanent pasture, forages, cereal crops, oilseed crops, crop-fallow rotations, continuous cropping, no till versus minimum till, etc. All of these are patterns that apply to objects (here farm fields) and that can only be recognized through reference to temporal variation in land cover patterns within these objects (and not within individual pixels). This issue is of great interest for monitoring land use practices for conformance to Kyoto agreements. I fully expect to see something like this become required to monitor for conformance to Kyoto agreements.

From the point of view of forest cover mapping and monitoring, you want to flag locations where changes in the previously mapped condition of the forest has occurred. Once flagged, you want to go to the locations of potential change and review the latest image

	information to compare it to previous image information for the same location. If a change can be verified, you need to record the kind of change and the extent of the new area that it applies to. In this way, you create a time-stamped map and record of what changes have occurred in the forest cover, when they occurred and where they occurred. This time-stamped spatial data base can be queried to create multi-temporal maps that depict change through time. You might like to visit the web page for TimeMap (www.Timemap.net) to get an impression of what a temporally variable map can look like.